THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXVI. No. 2137.] LONDON, APRIL 26, 1904. [56TH YEAR. PRICE 6d.

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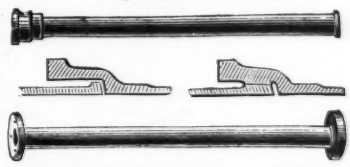

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Saves its Cost many times each Year.

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After being subjected to the blast of steam and air which is injected, the scurf is easily removed with a bar without violence and consequent damage to the Retort itself.

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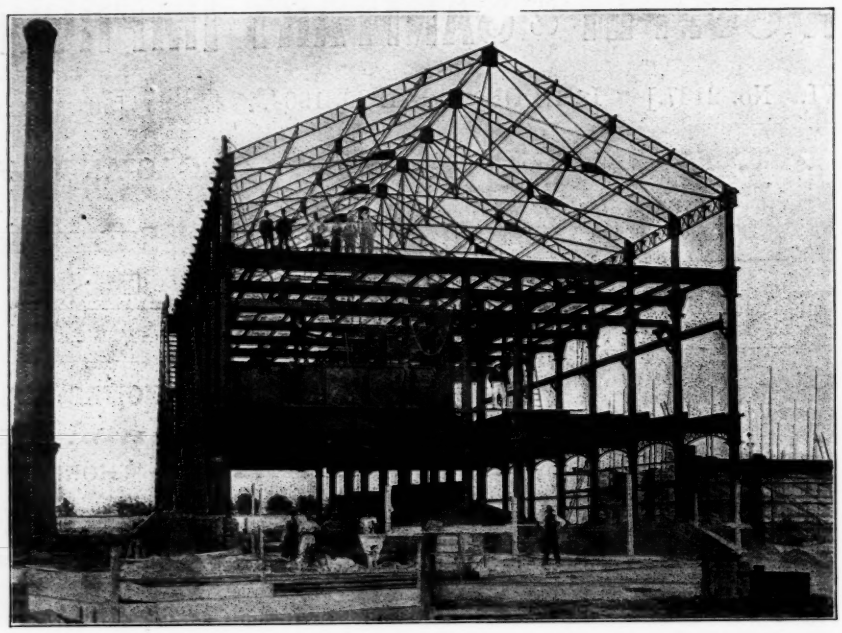

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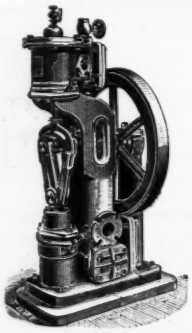

Fig. 705. "SINGLE RAM" STEAM-PUMP.

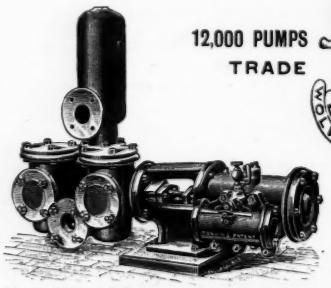

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

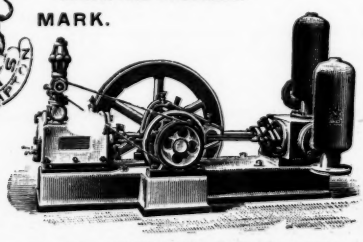

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

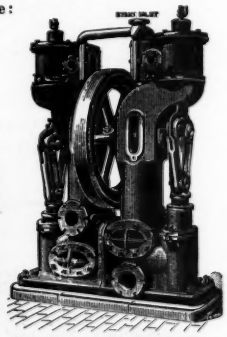

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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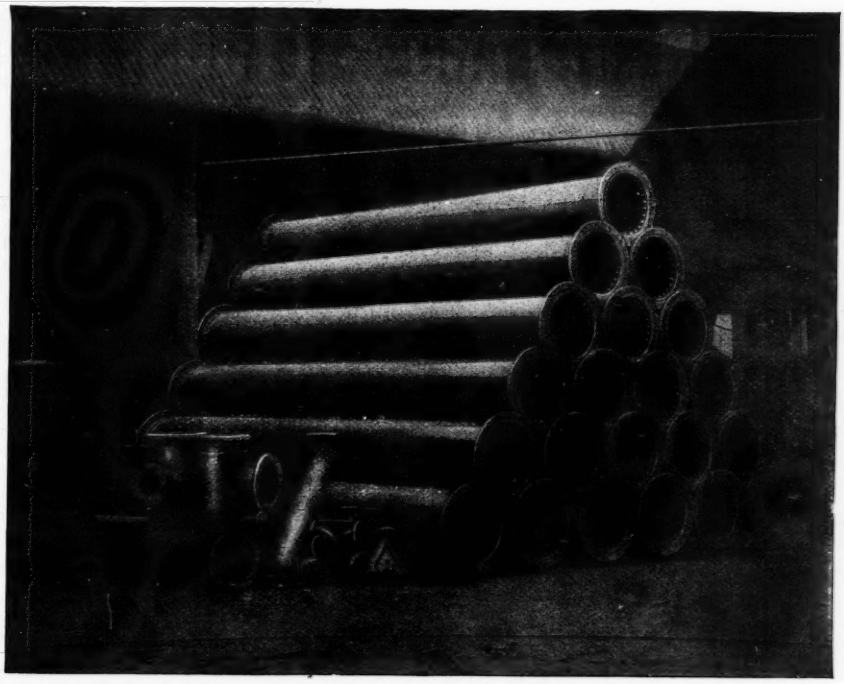

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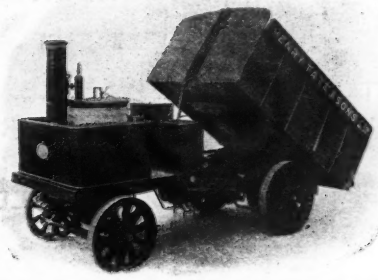

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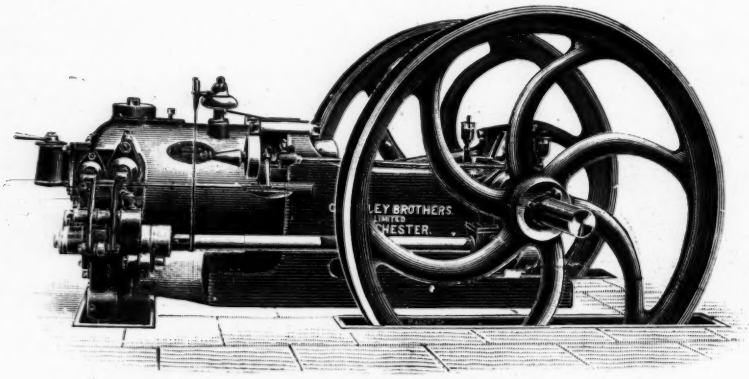

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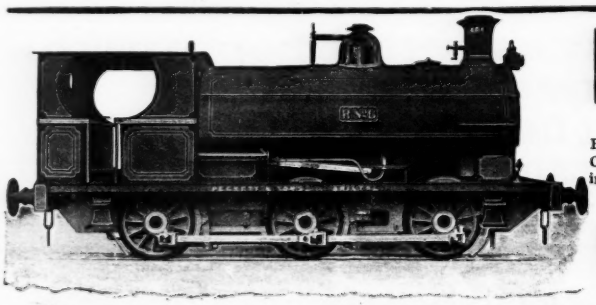

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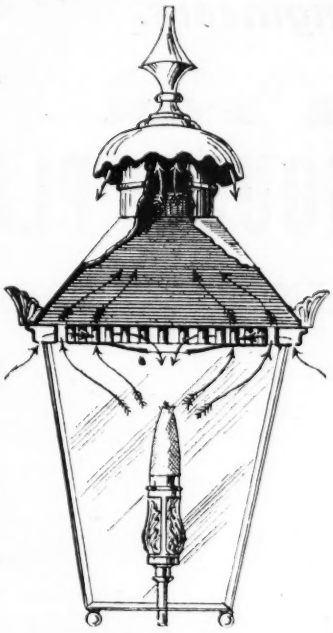

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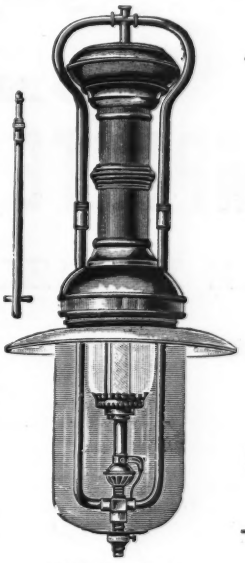

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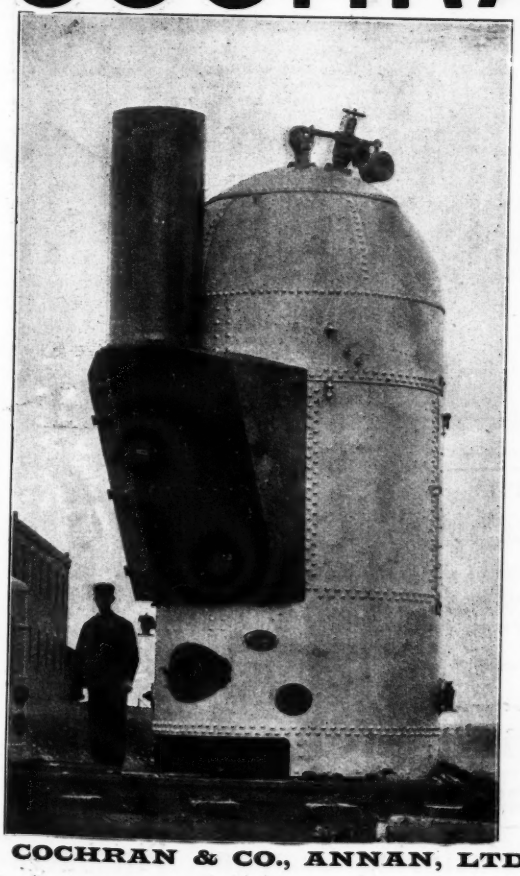

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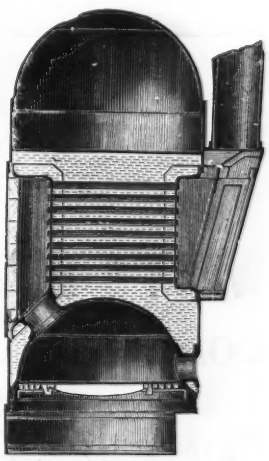

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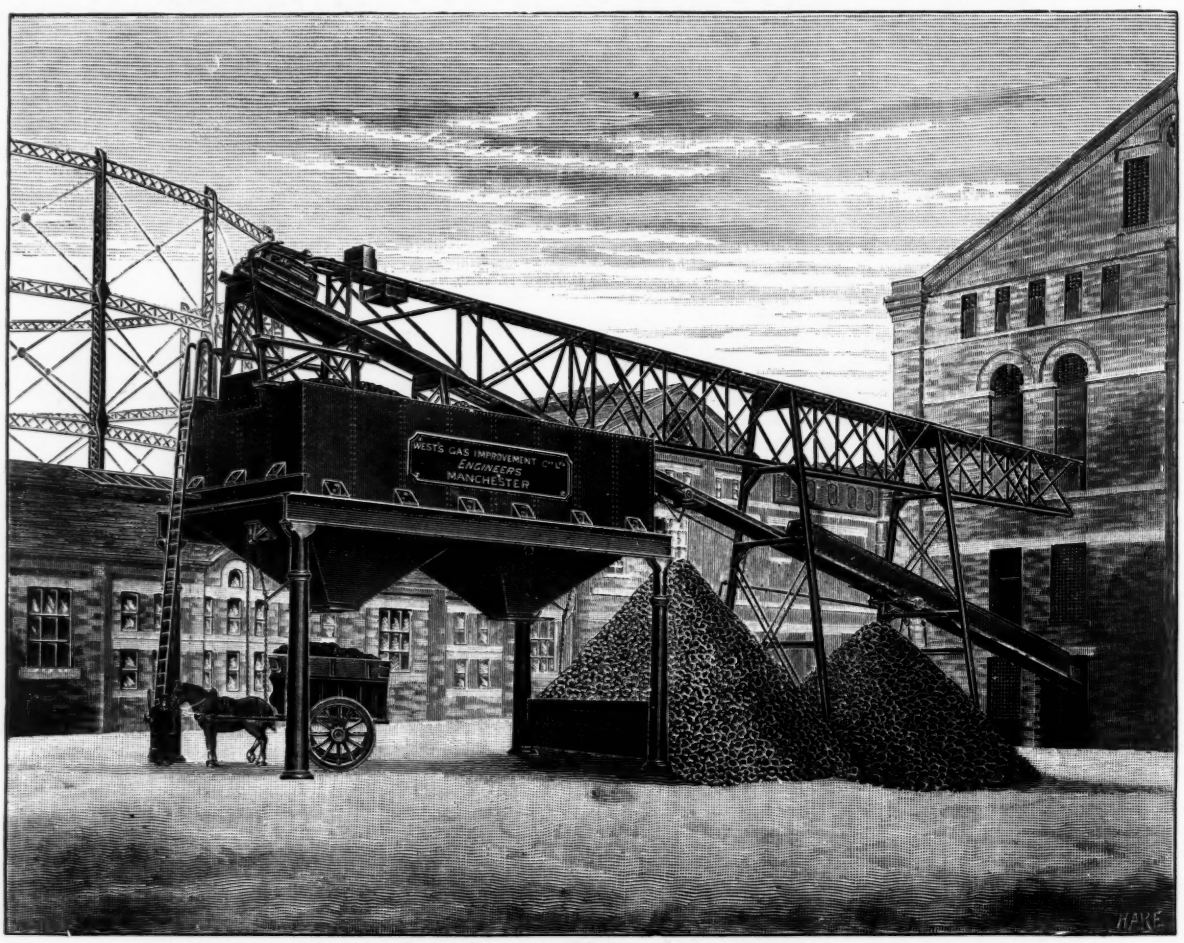

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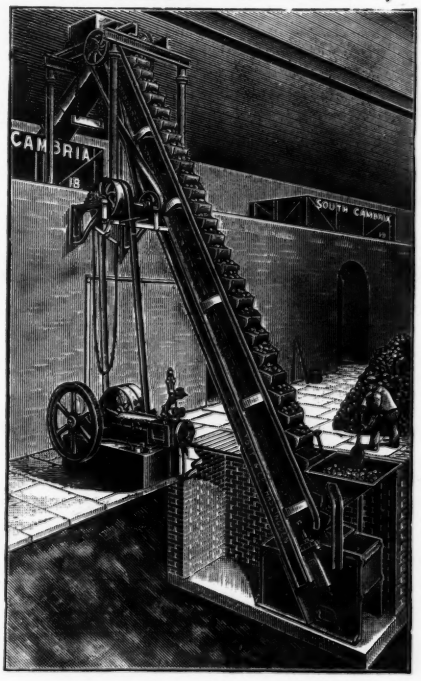

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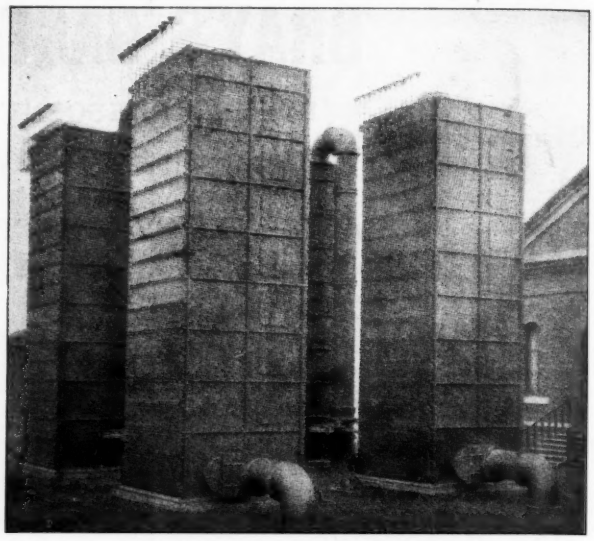

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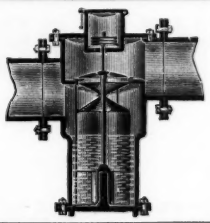

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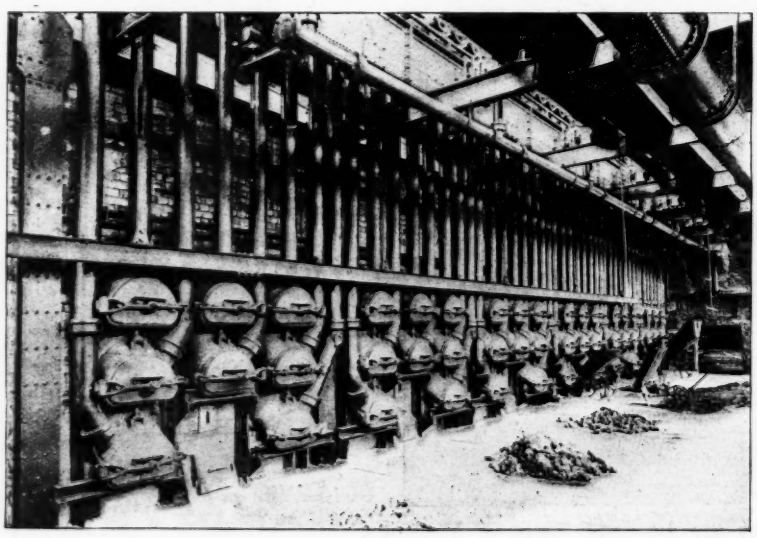

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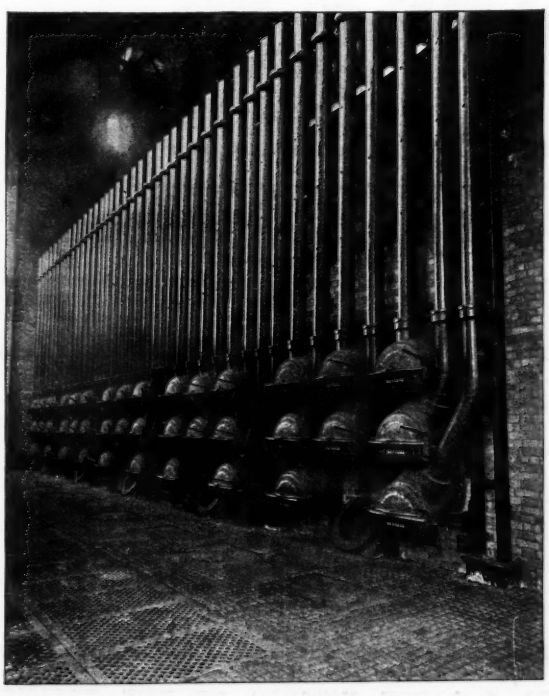

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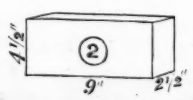

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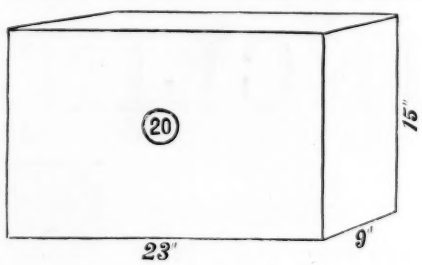

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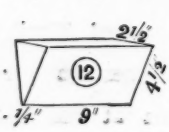

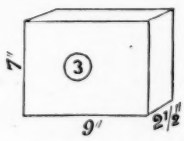

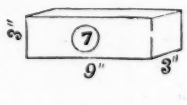

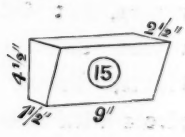

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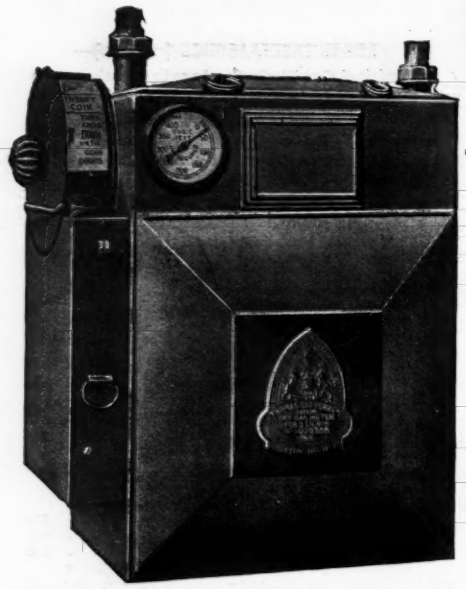

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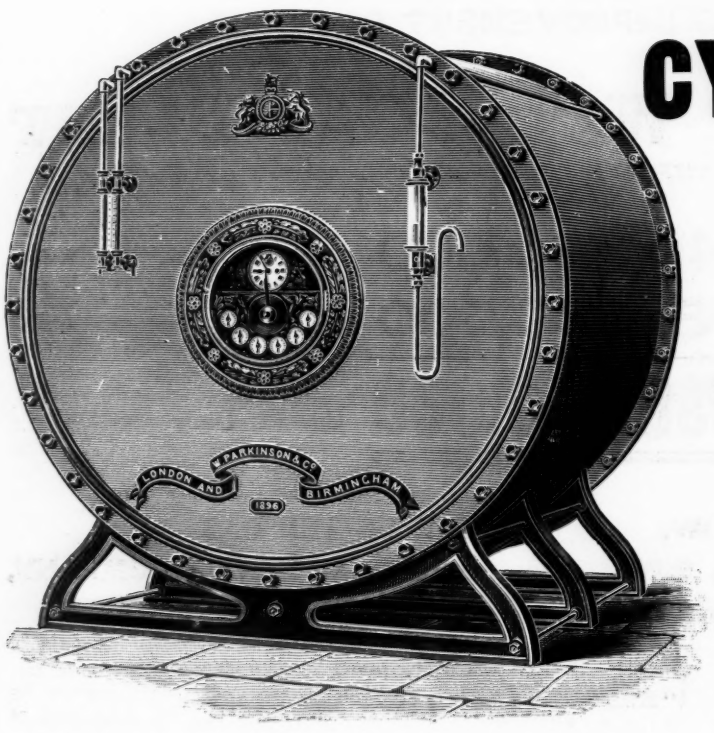

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VOL. LXXXVI., No. 2137.—TUESDAY, APRIL 26, 1904.

EDITORIAL NOTES—GAS, &c.

The Budget—A Higher Income-Tax.

THE Budget statement of the Chancellor of the Exchequer has turned out to be of quite a non-sensational character. The income-tax is raised from 11d. to 1s. in the pound; and tea and tobacco are called upon to make up the rest of the deficiency in the national revenue. With regard to the increase in the income-tax, it is satisfactory to know that an inquiry is also to be held into the way in which the Commissioners assess the tax in certain cases, mainly industrial. It can hardly be said that the increase was unexpected. Of course, it is none the less unwelcome for that. But it is idle to protest against the inevitable; and most people thought last year that the reduction of 4d. was rather too bold a stroke. The truth probably is that the nation is still suffering more than is commonly suspected from the strain of the war; and it is necessary to find a great deal of money yet to get affairs safely restored to a peace basis. Most people are unaffectedly sorry that, for the sake of a sentiment of fiscal purism, the corn-tax, which nobody felt, was thrown away last year. Not a word was uttered by the Chancellor of the Exchequer about taxing petroleum, nor were any other new sources of revenue named. Altogether, the Budget statement may be regarded as a striking lesson for the people upon the exceedingly narrow basis of the national taxation. If trade languishes and the markets are dull, there is no other resource for the Exchequer than to raise the income-tax. If people will not allow a corn duty to be collected, they must be content to see tea taxed to make up the deficiency. Not much "freedom" about this scheme of food taxes! Assuming that the consumer pays in any event, his only alternative is to pay on his cup of tea instead of on his bread-and-butter. We are quite as far removed from the "free breakfast-table," in either case. The fact of the income-tax being at the level shilling, or 5 per cent., is not the most reassuring aspect of this impost. It was fully recognized that an income-tax of such an odd figure as 11d. in the pound excites remark, and challenges reduction, while an even shilling does neither. Still, there remain grounds for the hope that the pinch is only a temporary one. Hope springs eternal in the taxpayer's breast, that he shall some day be favoured with the opportunity for making out his return in the figure of sixpence in the pound. Who knows? It is more probable that before this happens again the whole scheme of national taxation will go into the melting-pot, and come out in a different shape. But it is not possible to feel extravagantly gay, even in the face of this dim and distant prospect; because, apart from the remoteness of any chance of radical change, one cannot dispel the suspicion that it will not make much difference after all. Taxes must be paid, somehow; and there is no encouragement for the expectation that they will ever be substantially less in total amount than they are now.

Rejection of the Cheshire Mond Gas Bill.

THE rejection by Mr. Cawley's Committee of the Cheshire Electricity and Power Gas Bill, without calling upon the opponents for their evidence, may possibly be regarded as the turning-point in the career of Mond gas speculation, which began flourishingly with the South Staffordshire Act of 1901. Many engineers who looked into the matter thought this Act was passed against the weight of evidence; but there will at least be no dispute over the assertion that it was allowed to pass for the sake of experiment. It was followed by the North-Western Electricity and Power Gas Act of last year, from which the whole of Cheshire, originally included, was struck out by the Committee. This measure only passed where it was unopposed. The Cheshire Bill now in question was designed to restore this county to the place marked out for it in the Mond gas scheme. The course of events since 1901 has not been favourable to this enterprise. The pioneer South Staffordshire Company have not yet justified the promises of the promoters. So poorly do local people now appear to think of this concern, that money has to be paid to get rid of the shares, on which there is a liability of £4. Though a good deal has been done to the works, no evidence was given for the enlightenment of Mr. Cawley's Committee as to the prospects of the concern. Even if the period that has elapsed since the South Staffordshire Act was passed is regarded as too short for the achievement of results, it might have produced some definite indications that the expectations of the founders of the Company are not doomed to eventual disappointment. Nothing of the kind was tendered in evidence to the Committee; and therefore the Chairman attached the greatest importance to the financial reputation of the Company, which, as already stated, is not of the brightest. He inquired repeatedly whether, in face of this record of the pioneer Company, there might be considered to be any prospect of the Cheshire Company getting the capital of $1\frac{1}{3}$ millions sterling which was named in the Bill; and the unanimous rejection of the measure by the Select Committee is the only possible answer to the inquiry.

A weaker case for so heavy a capital commitment has rarely been submitted to Parliament. One can only admire the robustness of the faith of the promoters, in thus putting their fate to the touch while the omens were so dead-against their proposals. Though the presentation of the promoters' case occupied several days, no fresh proof of the advantage of distributed Mond gas was brought forward by anybody concerned. When one recalls how often the "benefits" of this new industry have figured in papers contributed to technical societies, the poverty of the parliamentary case for the latest of the Mond Gas Bills appears unaccountable. It is remarkable that, after all these years, presumably utilized by a devoted band of professors and others in working on Mond gas, it should have been left to Mr. Sturgeon and Mr. Humphrey to repeat to a Select Committee of the House of Commons the generalities on which the promoters proposed to erect their monopoly for Cheshire. Where were the manufacturers who are said to have found commercial salvation in making Mond gas for themselves? It was not merely the case for producer gas distribution that lacked exponents. Nobody took the trouble to come and testify to the advantages of Mond gas for private use. If the partisans of this gas could not make a better showing for their fancy than was done on the Cheshire Bill, it does not seem an extravagant conclusion that it is almost a negligible quantity among the industrial assets of the time.

Those who are concerned with the gas industry of the United Kingdom are to be congratulated on the collapse of a threatened rivalry which it was extremely difficult to grapple with. There was so much to question in the Mond gas propaganda, as it was carried on in Parliament and in the country, that the unanimous rejection of the latest proposal to sell "gas at 4d. per 1000 cubic feet" comes as a welcome relief. Rarely has the gas industry been confronted with a more perilous passage than that which was forced upon it in 1901, when the dazzling promise of "four-penny gas" first burst upon an astonished community. Taken in conjunction with the world-wide reputation of Dr. Mond, and offering itself as a means for the restoration of prosperity to South Staffordshire—and also as a means of escape from the monopolistic dealings of a host of grasping local authorities, all trading in gas for profit—it is hardly to be wondered at that Mond gas sprang into a temporary vogue. Far be it from our desire to suggest any disparagement of the value of the chief factors in this combination—the reputation of Dr. Mond and the success which had attended his labours on the gas-producer. Both are real and deserving of high esteem. But the project of the South Staffordshire Mond Gas Company was not to be judged by Dr. Mond's personal gifts as an inventor, nor on the data of his works practice at Winnington. It was for the followers of the gas industry to maintain their position as manufacturers and distributors of really the only kind of

combustible gas economically adapted to the purpose. They put forward their case to the best of their power and ability; and although they (not altogether unexpectedly) failed to carry Parliament with them in the attempt to negative the promises as to Mond gas, they succeeded in holding their ground. There is not much pleasure, however, in knowing that a good deal of money has been lost in proving this conclusion.

Eastern Counties Gas Managers' Association.

It cannot be expected that the officials of an Association can always keep its proceedings up to a high-placed mark. To do so, they must be in a position to command and obtain the very generous support of the members, both before and at each meeting. But for two prepared contributions, the meeting last Wednesday of the Eastern Counties Gas Managers' Association would have been sterile indeed for those who look rather to the technical results than to the ordinary administrative and social sides of such an assembly of professional men. The exceptions were the admirable and suggestive paper by Mr. Thomas Glover, giving some of his "thoughts" on the regulation of pressure, and the narration of an untoward experience which Mr. J. S. Dougall has had with a burst gasholder tank. The latter was not a subject which lent itself to discussion; but Mr. Glover's paper—concise, yet full of point, and illustrated by several beautifully prepared diagrams—contrary to all anticipation called up but few speakers, and from the few but little comment. The somewhat unique separation of the gas plant at Norwich presents features of peculiar interest to the gas engineer; and it has given Mr. Glover good scope for the exercise of his ingenuity. To this division of the plant we are no doubt indebted for the experience and the pressure-chart showing how perfectly a steady and reliable exhaust can be maintained on the foul mains in the retort-house by the use of governors. The interest of the matter notwithstanding, only Mr. A. E. Broadberry found in it a peg on which to hang a few remarks. The novelty of the second pressure-chart, showing the pressures prevailing inside a retort working without hydraulic seal and with the pressure steadily maintained at zero on the foul main, was also neglected by the members. But more astonishing still is the fact that there was not even a word of praise for, or criticism of, the new practice at Norwich in respect of the governing on the consumers' premises of the gas supply to gas fires and cookers. Until something of the same kind is generally done, the former can never hope to reach the same level of popularity that the latter has attained. These are only two or three among the many points of the paper, the merits of which and the work put into it were far from being adequately recognized on Wednesday by making it the centre of a good discussion.

This was the first meeting of a District Association since the issue of the resolutions passed by the Council of the Institution of Gas Engineers on the subject of affiliation; and the result of this first consideration was that only three members voted against the motion to affiliate on the understanding framed by the resolutions. Some question was raised as to the amount of the annual affiliation fee for the less wealthy of the Associations; but we do not think that, on reflection, any one of the Associations would care to sacrifice their dignity by accepting any reduction that could be made below the suggested five guineas. Preferential treatment through any cause would shake the feeling of equality and independence.

Among general matters, it will be noticed that the Association have added to their ranks some excellent recruits, whose sympathy and interest in the organization, it is hoped, will be shown in the form of some activity beyond the payment of the annual subscription. The Earls Court exhibition was brought under notice by the President (Mr. J. H. Troughton); and he urged the members to do their part in enlisting the co-operation (by financial aid) of their Companies and Committees in this scheme for the production of common benefit. The members elected the office-bearers for next year, which in the case of this Association commence with the autumn meeting. Mr. J. S Dougall (whose record in connection with the Association shows that he shares with his brother a strong aptitude for organized work of this kind) has been elected President; and an old hand is brought forward again by Mr. R. G. Shadbolt being induced to accept the Vice-Presidency.

Bill to Make Trade Unions Irresponsible by Law.

If the House of Commons did not occasionally indulge itself in a little "playing to the gallery," it would not be the intensely human, and consequently interesting, assembly it is. Considering the nature of very many constituencies, it is most praiseworthy of their representatives that they so generally resist the strong pressure constantly applied to them to "do something" for those who sent them to Westminster. Members for Government Dockyard towns perform in the House the serviceable, if undignified, part of the "dreadful "example" in this special regard; and their deplorable case undoubtedly helps the others to preserve their independence of judgment. There are some occasions, however, when the average borough member thinks he can safely treat himself to a little pandering to that pampered section of the community, the working-class voters; and this usually occurs in connection with some Labourist resolution or Bill that comes to the front on a private members' day. There is a very intelligible temptation, which appeals to members of all shades of political opinion, to give a "popular" vote when it cannot amount to anything serious. Accordingly, last Friday the House gave a second reading to the Trade Unions and Trade Disputes Bill, a measure of three clauses, which has for its main object the overriding of the Taff Vale and other famous legal decisions that have made Trade Unions answerable for the unlawful acts of their agents, and stopped besetting. The Prime Minister did not take a strong or decided line against the Bill, though he personally opposed the second reading, on the ground that the measure would abrogate broad principles of law, applicable to all classes and all interests, in a particular interest, and also interfere with the liberty of the subject. One would think, if there were any logic in politics, that such weighty reasons might well have warranted the Government in offering the strongest resistance to any scheme of legislation open to such a construction; but Parliament is the last place where any respecter of logic would look for it.

The result of the division on the question was affected by the return to the House, for the express purpose of showing their sympathy with Trade Unionists, of a strong contingent of Irish Nationalist members, who claimed all the credit for the victory. It was a regrettable result, for a good many reasons. This is not the time, and the House of Commons is not the place, for any encouragement to be afforded, even in appearance only, to inequality of the law. Ignorant impatience of legal restraints on self-regarding acts, and a propensity to pick and choose as to which laws a man shall obey, are ugly signs of the times upon which the Imperial Parliament should scorn to take up a temporizing attitude. The plea which doubtless weighed most with some members on the present occasion, was that the sick and other benefit funds of Trade Societies ought not to be attachable for the payment of damages caused by the rash act of an angry striker. There is something in this—perhaps enough to attract a certain amount of sympathy from vague persons, who will not give themselves the trouble to ascertain all the facts; and unfortunately many well-meaning Members of Parliament come into this category. Practically, the most valuable outcome of Friday's debate was the suggestion of the Attorney-General, that Trade Unions should separate all their benefit funds, and put them in trust for these purposes. The effect of this proceeding would be that the money could neither be employed for warlike purposes, nor made liable for damages for wrongful acts of the Union officials. This is a very important proposal of which there is not the slightest doubt that more will be heard.

With regard to the other question, of answerability to the law for the acts of its agents, it can never be too often pointed out that the law is exactly the same for Trade Unions as for every other body, corporation, company, or person. It has pleased some persons to fancy that societies of working men ought to be above the law. The Bill now in question would make them so, crudely and comprehensively. Even as regards conspiracy, if the cause of offence were connected with a trade dispute, the aggrieved party would have no remedy. The Attorney-General pointedly remarked, on this part of the case, that what appears to be now wanted, in the interest of the public, is not a relaxation or remission of the law of conspiracy, but a considerable extension and strengthening of it. He instanced "trusts," where these arrangements operate in restraint of trade and detrimentally to the public, as the subject of his thoughts in this connection. There

used to be in force laws against "forestalling and regrating," which are operations that now constitute the soul of Stock Exchange business. It may or may not be practicable to devise a legal remedy against combinations of traders which operate to the disadvantage of the public; but if anything of the kind is attempted, or if the state of the law revealed in the Mogul case is to be altered, it must apparently be by developing the law of conspiracy in a suitable manner. To effect this extension, while leaving trade cases of another kind outside the scope of the same law, would be absurd. Notwithstanding these and other weighty considerations advanced by the regular advisers of the House of Commons, popular politics prevailed so far as to give the Bill a second reading; but there the matter came to an end, for a motion brought forward to refer the measure to the Standing Committee on Law failed.

The Law as to Stoppages from Wages.

One of the most important decisions affecting the payment of wages that have been placed on record for a long time past, was delivered last week by the Court of Appeal, consisting of the Master of the Rolls, with Lords Justices Romer and Mathew, in the case of *Williams and Others v. North's Navigation Collieries* (1889), *Limited*. It was an appeal by the defendants from an order of Mr. Justice Bucknill, at Chambers; and it was specially reserved for disposal by the full Court upon its merits. The question at issue was as to the right of an employer to stop out of wages any money by way of set-off to which he is legally entitled. The cause of action arose in the following way: Certain miners in the employ of the Company absented themselves from work without either leave or notice. Summonses were thereupon taken out against them in a Court of Summary Jurisdiction, under section 4 of the Employers and Workmen Act, 1875, claiming damages for this breach of contract of employment. Upon the hearing, every man was ordered to pay the Company 30s. as damages; the money to be payable in three fortnightly instalments, on the next usual pay-days of the colliery. Accordingly, on the first of these days, the Company stopped 10s. from the men's wages; and thereupon they brought an action to recover the amount thus deducted, and to restrain any further deductions, on the ground that such stoppages were illegal under the Truck Acts. Mr. Justice Bucknill granted an injunction. The defendants appealed; and it was agreed to treat the application as the trial of the action.

The plaintiffs relied fully upon the words contained in section 3 of the Truck Act, 1831, which are: "The entire "amount of the wages earned by, or payable to, any artificer, "in respect of any labour done by him, . . . shall be "actually paid to such artificer in the current coin of this "realm, and not otherwise." It was admitted that any fines or agreed deductions, such as payment to a doctor or other applications of part of his earnings authorized by the workman, might be lawfully stopped by the employer out of the wages. Such moneys, though "earned," are not "pay-"able" to the workman, in the language of the Act. This is the distinction; and it is worth bearing in mind. The plaintiffs here, however, took their stand on the literal meaning of the first three words of the clause already cited, even going the length of claiming that the requirement actually applies to an employer's failure to pay wages through inability. This is really to make non-payment of wages an offence under the Truck Acts; and such an unwarrantable stretching of the purpose of the statute materially helped the Lords Justices of Appeal to clear up the merits of the case before them. They first of all distinguished the main object of the Truck Act as being to prohibit the payment of wages otherwise than in current coin of the realm. Thus they were able to show that the plaintiffs' contention sought to put something into the language of the Act which it was not intended to mean, and does not mean. From this stage it was easy to arrive at the conclusion that a legal set-off is merely a mode of calculating the amount of wages due. Hence the defendants in the case were within their right in stopping the damages out of the men's wages. The Court was unanimous on all the points submitted; emphatically declaring that the Truck Act does not apply to cases of non-payment of wages. Wages are recoverable by ordinary civil process, and the employer who does not pay them wholly or in part is not liable to prosecution for breach of contract.

The Great Fire in Toronto.

The comments recently made in these columns on the subject of town fires, and the relations of the gas supply to the fire brigade service, are punctuated by the news of the burning of 2½ million pounds' worth of property in Toronto. It is reported that the principal warehouses of the city have been reduced to ashes, and nearly 250 firms put out of business. About 130 buildings have been destroyed, with their contents; everything being swept away from a considerable area of the best part of the city. Among other items of interest in connection with this disaster, it is stated that not only was it caused through the defective insulation of electric wires, but that "the firemen were badly hampered "by the network of wires connecting the buildings in all "directions." This can well be understood. The check to the prosperity of Toronto, one of the busiest of Canadian cities, is very serious; and the sympathy of all their fellow-subjects will be extended to the suffering citizens. Our object, in mentioning the fire, is the same as that which inspired our comments on the Baltimore conflagration—to bring into due prominence the truth of the observation that the most extensive use of electricity for lighting and other purposes does not sensibly increase the security of modern cities from the great danger of towns in all ages. Fire is the chief enemy of cities; and the comparative safety in this regard of electric lighting is a commonplace of partisans of the system. It is possible to see, in the examples of Baltimore and Toronto, how the former truth persists in spite of everything that the advance of knowledge has rendered available for reducing and curbing the evil; and likewise how idle is the boasted superiority of electricity in the same respect. For it is mere trifling to pretend that the use of the electric light may diminish the risk of fire in the case of a shop or an office, as compared with a similar interior lighted by other means, while the whole town will burn together as fiercely as London did in the Great Fire. The greater risk exceeds the less. And here we see also, in the example of Toronto, a consequence of the general distribution of electricity which should never be overlooked—the hampering effect of the wires. It has been remarked that the presence of broken gas-mains, with their contribution to the inflammability of buildings, helps to make fires worse; and the circumstance that a broken electric cable cannot contribute anything to feed the flames has been duly acclaimed. But if a network of electric cables prevents the firemen from going about their duty, and thus hinders the work of extinguishing the flames, the result is the same as if the fire was fed by the addition of so much inflammable matter. There is no need to labour the point; at the same time the lesson ought not to be forgotten.

The Nantwich Award.

The award in the arbitration which was held last February to determine the price to be paid by the Nantwich District Council for the undertaking of the Gas Company is an illustrious success for the latter; and there must be a great revulsion of feeling in Nantwich over this municipalizing of the gas supply, if the Council built their hopes on taking possession of the property at anything like the figure their advisers gave in the arbitration as being its value. When it is found that the award exceeds their valuation by considerably more than 100 per cent., it suggests that someone has been egregiously wrong. But it is not any part of our business to sit in judgment on this matter. The Referees were Mr. Corbet Woodall for the Company and Mr. E. H. Stevenson for the Council, with Sir G. Bruce as Umpire. Mr. W. A. Valon, Mr. Henry Woodall, and Mr. W. Cash were the professional witnesses for the Company, and Mr. Charles Hunt was for the Council. From the report of the proceedings published in the "Journal" for March 1 last, it is seen that Mr. Valon's total valuation was £80,446, while Mr. Hunt's was £30,863. The award is £68,148. Mr. Valon's valuation was higher than the award by £12,298; while Mr. Hunt's was below it by £37,285! It should be mentioned, however, that Mr. Hunt gave no effect to the sale being, according to the Act, a compulsory one. He stated that he has never yet added a sum for compulsory sale and he left it to the Court. Even so, the addition to his valuation of the usual 10 per cent. would only have amounted to a little more than £3000. The Nantwich Gas Company and those who

advised them are to be heartily congratulated on the result; and they are in a position to wish the District Council joy of their bargain.

Rickmansworth Gas Arbitration.

Elsewhere in to-day's issue will be found an extended report of the proceedings which took place last week in the arbitration to determine the price which the Rickmansworth Urban District Council are to pay for the undertaking of the local Gas Company, as the result of the Purchase Bill passed last year. Sir George Livesey acted as Umpire; while Mr. H. E. Jones was Arbitrator for the Council, and Mr. J. Hepworth for the Company. Counsel for the Company, in his opening speech, stated that an arrangement had been come to that only two witnesses were to be called, apart from giving the Court any special facts they might want; and these witnesses were Mr. Corbet Woodall for the Company, and Mr. F. H. Jones for the Council. Mr. Woodall's valuation, based on the revenue account for 1902, and using as a multiplier 28½ years, was £36,188. To this he added £137 for the fittings profit (£27 10s., multiplied by five years), £3632 being 10 per cent. for compulsory purchase, and £1190 for surplus works, making a total of £41,147. From this, however, had to be deducted the mortgage debt of £3933, which brought his total valuation out at £37,214, subject to deduction for any floating liabilities of the Company. Mr. Jones, on the other hand, after making sundry deductions from the amount of profit shown in the balance-sheet, multiplied the resultant figure by 20 years, and thus arrived at a sum of £16,180. Adding to this £1618 the 10 per cent. for compulsory purchase and £137 for the profit on fittings, made his total valuation £17,936; whereas Counsel for the Company (Mr. A. Wedderburn, K.C.) said the total amount he claimed for his clients was £33,440, on the basis of the 28½ years' purchase mentioned by Mr. Woodall. In the course of the hearing, an interesting question was put to Counsel by Sir George Livesey, who asked whether (admitting that the first thing necessary was to give the shareholders such a price as would enable them to find an equally good investment without loss) the fact that gas stock was lower now than was the case some years ago, would make any difference in the number of years' purchase to be allowed. He pointed out that Mr. Shiress Will had said that the principle ought to be to give shareholders a price which would enable them to secure as good an income as they had been having. Mr. Wedderburn, however, urged that the shareholders ought to have a perfectly free hand as to their investments, and that the Court had nothing whatever to do with how they were going to lay out their money.

Progress in the Gas Industry.

When last year Mr. Irvin Butterworth made his first "Progress" report to the Ohio Gaslight Association, he took a birdseye view of the development in gas plant and appliances in the preceding five years; and he did the work well. In his second report, he has only had to review the past twelve months. Reporting progress in this manner is a healthy exercise for the diligent reporter; and the reading of it by others should be of value in refreshing the memory. The year which Mr. Butterworth now examines has been one the like of which cannot be looked for year after year; and in gas plant improvement, particularly for retort-house work, it has had no equal since the inclined-retort system was brought to its present pitch of perfection. It is some gratification to find in reading this report that there is little in it that can be described as "news" for "JOURNAL" readers. In, for example, the section in which the various new machines are mentioned for charging and discharging retorts, it is found that they have all been fully described in our pages from time to time. There is one point here upon which Mr. Butterworth will pardon us for setting him right. Speaking of the De Brouwer and Parisian projectors, he states that, notwithstanding that the retorts are 18 and 20 feet long, the coal is charged by them with such evenness that the coke can be easily pushed out by rams, "as it could not be with any other system of charging." The inventors of the Fiddes-Aldridge machine will not subscribe to the accuracy of this statement; and it has been established, to our satisfaction, that the ram method will discharge retorts fed by other types of machines. From this report, and the "Question-Box" volume of the same Association, it is found that Bronder has not stopped at the charging and discharging of three retorts simultaneously; but that there are machines of his actually in use dealing with four retorts at once. Inclined retorts are slowly making their way into America. Looking at the report generally as a review of the development in gas plant and appliances, there is no room for doubt as to the new retort-house apparatus excelling in interest any other department; and our American friends are keeping a sharp eye on these things. The reading of the report strengthens the confidence expressed some time since as to there being a revival of attention in America to coal-gas manufacture, improvement in which was for a time put into the background there by the rush into water-gas manufacture. Into the other parts of the report we cannot enter here; but one sentence must be quoted from it: "Some of the gas companies of America, including at least one large one, are now selling as large a proportion as two-thirds of their gas for purposes other than illumination." This needs no comment.

Results and Prospects at Manchester.

Among the results of the working of municipal gas undertakings for the financial year just concluded, those obtained by the Manchester Corporation Gas Committee and their Engineer (Mr. J. G. Newbigging) will take a prominent place; and accordingly we may expect to see them frequently referred to with jubilation by the friends of municipal trading, as a proof of the advantages accruing from the adoption of their views. And so they do show what a veritable mine of wealth is a well-managed gas undertaking, though this, of course, has times out of number been proved before, both at Manchester and elsewhere. After providing £90,000 for interest and sinking fund charges, and handing over no less a sum than £70,000 to the city fund, there remains a surplus of about £25,000 on the past year's working—the net profit having thus been something over £95,000. For the year ending March 31, 1905, it is estimated that, based on present prices for gas, there would be a net profit of nearly £74,000, without reckoning the surplus of £25,000 carried foward from 1903-4, which would leave them with practically £100,000 to dispose of. It will be remembered that last year a reduction of 3d. was made in the price of gas; and the present exceedingly prosperous condition of affairs has enabled the Committee to resolve upon taking another 2d. per 1000 cubic feet off the charge to ordinary consumers—making the price 2s. 4d. within and 2s. 7d. outside the city, with free meters and stoves. The concession is also extended to the public lamps. This will dispose of about £27,000 of the estimated surplus; and of the remainder, some £14,000 is to be spent on extension works for which the Corporation have no borrowing powers, £50,000 is to go to relieve the rates, and a balance of about £8000 will be left in hand. The consumers will thus derive a substantial direct benefit from the excellent working results; while should the Bill which the Corporation are promoting in the present session of Parliament become law, a number of the out-districts will be included in the city, and the consumers therein will then enjoy the additional advantage of being supplied with gas at city prices.

The Huddersfield Gas Undertaking.

The Huddersfield County Borough Council were engaged at their meeting last Wednesday in following, in a mild and unpretentious way, the proceedings in the House of Commons on the previous evening. They had before them the Budget for the current year; and it must be gratifying to the ratepayers to find that there will be no increase in the local rating to add to the burdens which a deficiency in the national revenue will impose upon them. Some of the branches of the Corporation's work are not quite so self-supporting as might be wished; the Tramway Department, for example, requiring a rate-in-aid of 5d. in the pound, and the Water Department calling for 7d. The gas undertaking, however, under Mr. E. A. Harman's management, is a flourishing one. According to some figures from the revenue account for the past financial year which are given elsewhere, the net profit on the working was £14,614. As a matter of fact, this would have been £4000 more but for the allocation of two sums of £2000 each to a suspense account for prepayment meters and stoves. Coupling these with the interest and sinking fund payments (£13,724), the gross profit on the year's trading was

£32,338, or rather more than 10 per cent. on the capital outlay. Even this amount does not fully represent the position of the undertaking, as not a penny has been added to the capital account during the past seven years—new mains and services, prepayment meters and stoves, and all improvements, having been paid for out of revenue. It is apparent, therefore, that the undertaking is in a greatly improved financial position, though this would not be revealed by a cursory glance at the accounts. Not the least noteworthy feature of the past year's working, some comparative figures in regard to which are given, is the addition of 928 new consumers, against 810 the preceding year; bringing up the total to 23,565. The figures showing the quantity of gas sold in the two years speak for themselves. With regard to the disposal of the surplus, we think the Gas Committee acted wisely in devoting about £8000 of it to reducing the balance of £25,099 outstanding on the reconstruction of works account. We quite sympathize with the consumers of gas for heating purposes in their desire to get it as cheaply as possible. At the same time, when there is an old debt upon an undertaking, the first consideration should be its removal. Gas consumers in Huddersfield have not very much cause to complain of being overcharged; and therefore Alderman Jessop, the Chairman of the Gas Committee, did well to remind a worthy councillor who questioned him on this matter, that the Committee must pay their debts before they could make any alteration in their charges—or, in proverbial language, must be just before being generous.

A Corporation and Economy.

The higher-paid officials of the Liverpool Corporation will have some reason to regret the reiterated demands which have lately been made throughout the country for the exercise of economy in municipal expenditure; for the City Council resolved last week, by a substantial majority, that the consideration of all increases of salary to officials receiving £400 a year and upwards should be deferred for twelve months. As to the particular case of Liverpool, there is no need to speak here; but with reference to the general principle involved, we must protest against the injustice of the paid servants of municipalities being among the first to suffer for a state of affairs which they have done nothing to bring about. In many places, economy is needed, and needed badly; but it is difficult to believe that the Liverpool City Council have hit upon the direction in which it should be begun—or, indeed, in which it is most urgently called for. It is true they have merely decided for the present not to grant any increases; but how long will it be before some other authority, in their new-born zeal for retrenchment, go a step further, and decide to reduce the salaries of their officials? The mover of the resolution referred to remarked that "every little increase of expenditure went to make the burdens of the ratepayers heavier; and he thought those in receipt of high salaries should take their part with the general body and wait for brighter times, when the burdens of the ratepayers would be lighter." No hint was given as to when these "brighter times" were expected to dawn; and though the municipal rates are at present no less than 8s. 7½d. in the pound, it is to be feared that an improvement in this respect may possibly be some considerable distance off. The Liverpool City Council would seem to have been somewhat unfortunate in their adaptation of the good old saying "Take care of the pence," &c.; and if as a result of this policy they, and others who may be tempted to follow their example, should lose the services of their most valuable officials, they may be brought to sorrowfully confess that there is such a thing as false economy.

Casual Labour in Gas-Works.

Every now and again questions crop up as to the terms of employment of winter hands on gas-works; and it will be remembered that some time ago the Sheffield United Gas Company were defendants in an action brought by one of their men to recover a fortnight's wages in lieu of notice, owing to the wording of a set of rules displayed in the retort-house. The Company had previously given the man a fortnight's notice, after the expiry of which they said his services would not be required except on daily engagements; but as one of the rules stated that fourteen days' notice would be given and required from retort-house hands who had worked fourteen consecutive shifts, and the plaintiff subsequently while working by the day fulfilled that condition, the High Court held that this rule controlled the relations between the parties, though the County Court Judge had in the first instance decided differently. The decision appeared to be somewhat hard on the Company, for their object in giving the first notice was abundantly clear; but the case depended upon a particular set of circumstances, and so was not generally applicable. The Gaslight and Coke Company have been more fortunate in actions brought against them by three of their men (who were employed on a night shift during the winter months) for a week's wages in lieu of notice. All the men had worked for the Company through the busy season on many previous occasions; and none of them had signed contracts. The foreman stated that men without these agreements did not receive a week's notice; but they were told when the work was slackening to look out for another job. The same course had always been pursued during his 25 years' experience. The Judge at the Bow County Court considered that there was no contract for a week's notice; and he therefore found in favour of the Company. It is hard to see what the men had to complain of, for it was stated that (with the exception of one who was absent from work at the time) they received warning that their work was about to come to an end. This decision appears to apply more to the general conditions of casual labour in gas-works than did that in the Sheffield case above referred to.

WATER AFFAIRS.

Further Observations on London Water.

In the "Journal" a fortnight ago, we directed attention to the portion of the recently issued report of the Royal Commission on Sewage Disposal in which Dr. Houston expresses, in somewhat alarming language, his views on the state of the Thames above the intakes of the Water Companies at Sunbury and Hampton. He shows that, at the time his samples were taken, the raw water on which London depends to a large extent for its supply was in a very unsatisfactory condition from a bacteriologist's point of view. As the Commissioners were desirous of ascertaining, for purposes of comparison, the bacteriological condition of the filtered water as delivered to the consumers, some analyses were made of samples obtained from the mains of the East London and Southwark and Vauxhall Companies. It may therefore not be uninteresting to give Dr. Houston's observations on these examples, by way of supplementing what has already been said. The results showed, he says, that the filters were not intercepting microbes of "presumably" intestinal derivation. But while his examination compelled him to record this conclusion, he admits that, having regard to the meteorological conditions which prevailed during the period of collection, the results he obtained possibly did not truly represent the "average condition" of the filtered waters. We should say most unhesitatingly that they did not; and we would even go so far as to declare that the presence of the microbes they revealed had no deleterious effect whatever upon the consumers. Indeed, Dr. Houston practically admits this. He urges, however, that it is wrong to contend that, as no "untoward result" followed this bacterial manifestation of potential danger to health, the presence of the *bacillus coli* in drinking water is of small practical moment. We venture to think the absence of harmful results would amply justify the contention. We are well aware that, as he puts it, a fortuitous chain of circumstances might convert a potential into an actual danger to health. For example, it is quite conceivable, as he suggests, that coincidently with a breakdown in the filtering arrangements, a widespread epidemic of enteric fever might occur in one or more towns discharging sewage or imperfectly purified effluents into the Thames or the Lea above the intakes of the Water Companies; but is it really worth seriously regarding as a probability? We think not; and we are pleased to find Dr. Houston with us on this point. He says that though the continuous passage of bacteria, seemingly of excremental origin, in any number through filters, should be regarded as evidence of "inherent "weakness" in the system, which invariably suggests the possibility of danger, this weakness need never, perhaps, be "exaggerated to the pitch of a complete breakdown in the "process." Nor is it, in his opinion, desirable to push unduly the question of potential danger to health.

Let us now see what conclusions Dr. Houston comes to from the results of his examination of filtered London water. In the first place, they seem, he says, to lend confirmation to the old-established view that the filtration of water is a relative, and not an absolute, safeguard. They suggest that the objectionable biological qualities of the water before its filtration were insufficiently modified by the process, though there was certainly a marked diminution in the total number of microbes. At the same time, the results might, he considers, be fairly used as an argument against condemning water owing to the mere presence therein of the *bacillus coli* or gas-forming coli-like microbes, irrespective of their relative abundance in the samples, inasmuch as in this instance water was actually being drunk, "without obvious detriment "to health," which uniformly contained these creatures in ten and sometimes even in one cubic centimetre. There would appear, therefore, to be no justification for the wholesale condemnation of potable waters owing to the mere presence of coli-like microbes, irrespective of their relative abundance. Taking a broad and common-sense view of the whole investigation, Dr. Houston considers that the inference is warranted that a water which, from a bacteriologist's standpoint, would be deemed very impure indeed, may, after its filtration, though still containing an appreciable number of bacteria seemingly of intestinal derivation, be used for domestic purposes "without any very definite or detect-"able harm resulting." While saying this, however, he makes it quite clear that the statement in no way implies that he considers impure waters, even after careful filtration, are uniformly safe for potable purposes; indeed, he holds rather the contrary view. Taking, however, the results brought out during the period of his observations—and it is with these that he is specially dealing—they indicate the danger of hastily condemning waters without a wider knowledge of the correlation of bacteriology and epidemiology than is at present available. Another pronouncement by Dr. Houston must not be excluded from this further notice of his report, and it is this—that the water of a tidal river, grossly polluted in its lower estuarial reaches, may, after a flow of some 25 miles, become so far purified as to be even less objectionable, bacteriologically regarded, than certain public water supplies. Being strong believers n the self-purification of water, we are pleased to place on record the opinion on this subject of a bacteriologist whose special investigations have enabled him to speak with an authority which commands serious attention.

The Price of Thorium.—A letter received yesterday stated that the price of thorium has advanced by 25 per cent. This is a confirmation of the paragraph published last week (p. 159).

Anthracite Culm for Producer Gas.—In a paper read before the Scranton Engineers' Club, Mr. J. Gardner Sanderson gave estimates for a 100,000-horse power gas-power plant to utilize anthracite culm for fuel; also for a steam-power plant of the same capacity, and operated under similar conditions. The cost of the former was put at about £800,000; and that of the latter at about £1,000,000, exclusive of buildings in each case.

Parsons's Steam-Turbines for Gas-Works.—Messrs. C. A. Parsons and Co., of Newcastle-on-Tyne, are building a special type of gas-exhauster driven by one of their steam-turbines for the Glasgow Corporation Gas-Works. It has a capacity of 780,000 cubic feet per hour. A larger machine has lately been installed at the Coltness Iron-Works, Lanarkshire, and is giving great satisfaction. Its capacity is 1,700,000 cubic feet per hour. The plant draws from the liquor washers at 20 inches water pressure, and passes the gas to the clean liquor washers under pressure of 8 inches.

Novel Mode of Advertising Gas-Stoves.—Mr. E. A. Harman, the Gas Engineer and Manager of the Huddersfield Corporation, has adopted a somewhat novel method of advertising. By arrangement with the Corporation Tramways Department, the backs of the tram tickets bear the following advertisement: "Gas-Works, Huddersfield.—Cooking and Heating Gas-Stoves fixed free at low rentals. Full particulars at Show-Rooms, Leeds Road. Edward A. Harman, M.Inst.C.E., Engineer and Manager." Some millions of these tickets are now in course of circulation; and although, of course, many of them are not read, a great number are, while the cost is so insignificant that it is believed the policy will be advantageous to the Gas Department. From the accounts of that department it appears that during the past year, upwards of 15 million cubic feet extra gas were sold for stove purposes, &c., in Huddersfield. The importance of bringing to the notice of consumers the value of gas-stoves is generally recognized; but advertising upon tram tickets has not hitherto been adopted. It is a novel practice which may commend itself to managers of other gas undertakings.

HOW TO DO A COMPETITIVE TRADE IN DISTRIBUTED POWER.

THERE is a very widely-spread feeling among gas managers at the present time, that unless they are supported by their boards or committees—though the case as regards municipalized gas undertakings is somewhat different—in taking very special steps for retaining and attracting consumers, a good deal of trade will be lost to the industry. The danger comes from two directions, and does not therefore menace all in the same degree; but few gas undertakings of the United Kingdom are wholly free from it. In one respect, it is the tendency of house builders to leave off the practice, wherever they had it, of putting gas-pipes into new houses; and the other is concerned with the power branch. The facts are beyond dispute. Wherever building is active, and where a short time ago new consumers for the local gas company would have come along as a matter of course, the electric light canvasser is now very much to the fore; and the builder finds it cheaper as well as more fashionable to wire his "eligible residences" instead of piping them. On the other hand, where there might be a little more trade for the gas company serving a town district, or a suburban area in which workshops and factories might be planted, the cheap electric power unit on the one side, or the "suction" gas-producer on the other, compete fiercely for the custom. Leaving for the present the case of the suburban builder, and giving attention expressly to the trade competition for power, let us see how the rivalry actually stands. Many electricians have given the technical world the benefit of their views of the subject, whereas gas managers apparently prefer not to write too much about their experiences. This is to be regretted, for many reasons; because all the time they are grumbling that their competitors persistently misrepresent their case.

Stated shortly, the mere cost of distributed gas power, up to the sizes of prime movers usually found working in towns—that is to say, of anything under the cotton-mill scale—stands about midway between the cost of distributed electricity and that of isolated producer power plant. An instructive paper on electric driving for factories and workshops was lately contributed by Mr. Longbottom to the Manchester Association of Engineers, which has been published in several journals, and can be studied with advantage, as a fair statement of what the power user can reasonably expect to obtain from different methods of driving machine tools. Some of the points were given in the "JOURNAL" last week. It is desirable that the attention of power users halting between two opinions as to how they shall get their work done should be directed to the main points of Mr. Longbottom's observations. These may be summarized briefly as follows: Electric motors must never on any account be overtaxed. For this reason it is necessary that they should be run normally at not more than three-quarter load. The efficiency of the motor is then assumed to be 82 per cent.—an assumption which probably does not err on the disadvantageous side. In the case of a single motor connected with the supply cable, this is the whole extent of the loss between meter and tool; but where there are many tools, some of them grouped, or where subsidiary motors are required, whatever further loss these successive stages cause must, of course, come out of the main supply. Assuming that all these losses amount to another 20 per cent., the power actually used sinks to 60 per cent. of that purchased, which is not by any means a bad showing.

It is the besetting weakness of electrical writers on this subject to price the electricity delivered for power at from 1d. to 2d. per unit. Mr. Longbottom does not do this in his paper, because he deals with the case of electricity specially generated on the job. Yet he does mention the possibility of power users getting a supply from central stations at about this figure. Another witness to the advantages of electric driving, Mr. H. E. M. Kensit, writing in the "Electrical Review," boldly assumes that 1½d. per unit will be as much as any user of electric power need pay for his supply. He compares this with the cost of gas power, with gas paid for at the rate of 2s. 9d. per 1000 cubic feet. It is necessary to point out, in the first place, that this is not comparing the two supplies on the same basis. The gas is paid for at the decidedly profitable price of 2s. 9d. per 1000 cubic feet, whereas the competing electricity is charged at the equally decidedly non-paying price of 1½d. per unit. This is the starting-point from which the gas manager has to approach his employers first, before he can go forth to do commercial battle with his rivals. The purpose of the present article is to help him to perform this duty. By what right, commercially speaking, can a competitor, working a statutory undertaking like himself, browbeat the gas manager with an offer of electric power at 1½d. per unit? And this, be it observed, does not apply to business on the large scale, but descends, according to Mr. Kensit's calculations, to dealing with a baker who wants ¾-horse power actual for 15 hours per week, or even a mineral water manufacturer who runs a ½-horse power gas-engine. Now, it is known that certain London Electric Lighting Companies who have established "bulk" generating stations of their own, pay 3d. per unit for power delivered from these works by millions of units annually. How, then, can the above-cited small retail trade be done at half the money?

It is no part of the business of a gas undertaking to supply gas

for power or any other purpose at an unprofitable price. Let those who like to do business in this way live by their losses, if they can. But it certainly is the business of the gas manager to ascertain and lay before his employers a reasoned estimate of the price at which any branch of trade can be transacted without loss, having regard to the point of view of the customers. Gas directors have not hitherto been in the habit of bargaining for custom. There was no occasion for it. In coming under the statutory obligation to supply all comers on demand, and to show no preference as between customers, the administrators of British gas undertakings relinquished the market rule of bargaining. The permission to allow discounts or rebates, which some gas companies have to a high degree and others have not at all, is a mechanical equivalent for this relinquished freedom in dealing. Wherever gas is sold, like any other commodity, for what it will fetch, every consumer makes the best bargain he can. American gas companies do not disclose this side of their affairs. In endeavouring to do a trade in power gas, a company will naturally first try the value of offering certain discounts. The real object is to satisfy the customer. It is not for him to consider at what cost he can be served; but so long as the terms he is able to get from the local gas company strike him as fair, there is no more to be said. The circumstances of such a branch, however, quickly produce the type of customer who means to have a hand in the deal. He is by no means content to shut his eyes and open his mouth to receive whatever gift, in the shape of a discount, the gas company may offer. This is the man with whom it is expedient to agree, if possible. For this purpose, it is necessary to change places with him, in order to see the matter from his standpoint. This operation is not an easy one for some boards to perform. Gas directors, like railway directors, are prone to think they know how to do their own business, which generally means, sticking to their usual rates. Even railway companies will cut fares for excursion traffic. But just as the fine old crusted principles of a railway company are exploded by the advent of a ship canal or an electric tramway, so a gas board must bow to the inevitable, if it is to continue to exist.

Putting the problem in its extremest form, it is still wholly a question of value for money. Unless the prospective customer is regardless of the matter of price, all other things being equal, the gas-engine supplied from the town mains will beat electricity, also from the town mains, at anything like fair local prices for both. It is one of the fundamental principles of the gas industry that every undertaking is, for economical matters, a law to itself. We have, consequently, to speak of average prices under all reserves. But what is meant here is merely that, taking the annual accounts of both undertakings carrying on business in the same place, and ascertaining from them the respective cost prices of gas and electricity generated, the former should show itself from three to four times as cheap a source of energy to the user as the latter. Of course, average output costs are one thing; prices charged are different. And the ultimate cost to the user is another thing again. There are to be added the accessory charges—attendance, wear and tear, interest, and so forth—which may differ for various kinds of motors. To put it shortly, the user of a gas-engine can usually depend upon getting his brake horse power from a consumption of 20 cubic feet of ordinary gas per hour. If this quantity can be bought for ½d., which is after the rate of 2s. 1d. per 1000 cubic feet, the additional expenses may be half as much again; thus making the total working cost of the power ¾d. per brake horse power per hour. If the price of electricity delivered is 3d. per unit, as it ought to be to carry as much profit as the gas, and taking the cost of the electric brake horse power, *plus* additional expenses, as amounting to the price of the unit—which is not an unfair assumption—this proves our estimate of the relative real cost of gas and electric power, as 1 to 4.

As regards the rivalry of suction or pressure producer gas plants with common gas for engine working, the face advantage of cost, to the user, is almost precisely as much in favour of the former as in the case of the latter when compared with electricity. That is to say that, working with anthracite coal costing 25s. per ton delivered, other things being equal, the producer plant will make power at an inclusive cost of ⅜d. per brake horse power per hour or thereby. It would be vain to blink these facts. But, on the other hand, there are certain considerations to be regarded besides the face cost of the power itself. Unless he is an engineer himself, with suitable hands in the shop, and plenty of room for the plant and the coal store (to say nothing of the gas-holder), no power user would be troubled with a producer plant. The proportion borne by the cost of power to the total running expenses of a workshop is too small for such little economies as the margin in favour of the producer plant to count for much, if the advantage is to be purchased at the cost of any noticeable amount of extra trouble, risk of causing nuisance, or liability to any cessation of the work. Being able to depend on the constancy and regularity of the drive, is far more to the manufacturer than any fractional saving in the cost of the power, which does not altogether amount to more than 5 or 7 per cent. of the running expenses of his factory. The difference between a suction producer plant and a pressure plant is more of a mechanical than an economical nature. The former dispenses with the relief gas-holder; but the engine is much more dependent on the uniform functioning of the gas-producer, and irregularity of the gaseous fuel is just the one thing that the gas-engine is found to all too readily resent.

The above is a succinct summary of the facts with which the gas manager has to meet his directors. In order to be able to bargain with prospective customers, and to beat his rivals, he has to assume that they all know as well as himself where the shoe pinches in every case. If he is tolerably comfortable as regards price, in face of an electric power competition conducted on fair lines, he has often to reckon with anything but fairness. On the contrary, his electrical rivals will bid against him at less than half the price at which they could earn a living profit. And then, when it is a question of gas *versus* electricity at from 1½d. to 1d. per unit, the economy of the former may easily fail to persuade, when arrayed against fashion, and further inducements on the other side. Hence the gas manager should be authorized to bargain. It is the same as regards the competition of the power-gas producer, to meet which, on equality of price, gas would have to be delivered to the engine at not more than ¼d. per horse power, or 1s. 0½d. per 1000 cubic feet. But there are compensations; and something between the two figures would in most cases secure the trade for the gas-works. Bargaining again! It is probable that if good town's gas, and plenty of it, at ample pressure, could be had "at a price," there would not be so much trade in producer-gas plants as there is, and threatens to be. What this price might be, is always a question for local determination. If the problem of answering it was approached from the point of view of the consumer, knowing what he can do for himself elsewhere, it is probable that an ordinary conservative board of gas directors would be astounded at the figure that would eventually be reached.

ELECTRIC LIGHTING MEMORANDA.

The Burden of Kingston-on-Thames—The Remarkable Local Inquiry at Elland—An Impatient Inspector—Electricity Supply in Bulk Schemes in the Present Session.

One of the most impressive of object-lessons on the vanity of municipal aspirations after remunerative trading enterprises is supplied, much against their will, by the Corporation of Kingston-on-Thames. The circumstances of this deplorable municipal performance in the way of electricity supply have often been discussed in this column, because it happens to be so striking an example of the disappointing nature of this trade, when carried on in a small town. Yet Kingston-on-Thames is just such a place as might be supposed to be very suitable for an electric lighting venture. There is a well-to-do population of 36,000, compactly housed, with good suburbs. The electric light loans amount to about £70,000, which is nearly £2 per head of the population. Last week there was a Local Government Board inquiry into an application for £15,850 more. The money appeared to be what is called an "excess loan," respecting which the Inspector had some criticism to offer. He complained that the Corporation would not face their outlay, but went on spending money on mains in the hope of getting the business they sorely need, only coming to the Board for driblets of loans after the money had been spent. The present application was supported as a matter of duty by the Vice-Chairman of the Lighting Committee, though he could not honestly say he believed the result of spending the additional money would be to make the concern pay in the near future. The maximum demand indicator system of charging for current has been adopted recently, in the forlorn hope of enticing a larger number of the smaller householders to take the light, instead of the big shops and public buildings, which are regarded as unprofitable. The immediate effect of the change is expected to be a diminution of income, which, together with the additional cost of capital required, will eventuate in a loss of about £1500 a year. After ten years this is not a very comfortable state of things for the town; but little things like this must be, when "remunerative" municipal undertakings are started by unbusinesslike corporations unused to trade. Local opinion is very gloomy over the prospects of the undertaking, which hitherto has not conspicuously justified its existence, and is not now believed to possess any substantial chance of paying for itself.

Another instructive disclosure of "the way the money goes" when once a local authority undertakes electric lighting comes to hand from Elland, where, as was duly reported in last week's "Journal," an application of the usual character for another £4000 for distribution plant extensions was opposed by the Gas Company in their capacity of ratepayers. We may be sure that nothing of the kind was intended by the Local Government Board Inspector, but this gentleman's attitude towards the Company's representative laid him open to the imputation that he was not unprejudiced in their regard. He gave anyone who follows the report of the evidence the impression that he discounted the case of the Company, because of the nature of their business. We venture to submit that it was the Inspector's duty to hear the opposition, so long as it was relevant to the subject-matter of the inquiry, without casting reflections upon the ratepayer's calling. It is sufficiently notorious, one would think, that these local inquiries are a mere form when their subject does not happen to touch anybody's interest, or attract criticism from ratepayers who have some knowledge of the matter. Special opposition, on the merits, to a proposed addition to local indebtedness ought to be welcomed, and not snubbed, if this process of piling up

debt—of which everybody, from the Chancellor of the Exchequer down, complains—is to be checked at its point of origin. It is idle for the Government to protest against the borrowing propensities of local authorities, if ratepayers who have special qualifications for expostulating against municipal trading blundering and extravagance are suppressed on this very account. Of course, the Elland-cum-Greetland Gas Company were the right and proper ratepayers to expose the character of the recent proceedings of the Elland District Council, in seeking to borrow an additional sum of £4000 on the original capital outlay for electric lighting purposes of £11,094. It was estimated by the Consulting Electrical Engineer, Mr. Walter Emmott—whose competence is proved by the gratifying fact that the works were completed within the estimated cost—that there would be 6000 lamps, reduced to the 8-candle power equivalent, in the first network. So far there have been only 4500 lamps connected. There is nothing very much amiss with this estimate; and if the District Council had only exercised a little patience, and waited for the complete tale to be made up, there would have been nothing to say against their proceeding afterwards to extend the mains. As it is, the proposal was to increase the capital outlay by 45 per cent. with the object of getting the amount of consumption that was originally estimated.

The history of municipal electricity supply is one long tale of additions to capital for mains, before the first installation has justified the estimates. The open capital account has been the bane of this municipal business; and the fact is well known to the Local Government Board. The only opposition to the proceeding on the part of local authorities likely to be based on correct information, is that which the local gas company, if there is one, could supply. Yet it is well known that these companies have not opposed, as a rule, for the reason that the directors shrank from subjecting their case to the cheap sarcasm which so naturally suggests itself in this connection. It is so easy for anybody to say that whatever the gas company advance is "to be taken whence it comes;" that such companies have very generally consulted their dignity by remaining aloof. We have persistently challenged this policy of abstention; holding that the Inspectors of the Local Government Board, at any rate, would feel their hands strengthened for the difficult task of checking premature, or unjustifiable, increases of local indebtedness, by the evidence of truth which they would receive from the gas company. This confidence is rudely shaken by the Elland experience. When it occurs to the reporter for the local newspaper to head his report of the proceedings at the inquiry with "Inspector's Impatience with Objectors," one may reasonably feel that in this instance, at any rate, the enterprise of attempting to stop at its source one of those multitudinous rills which join to make the great volume of local debt, was hopeless. Let it be understood at once that the local inquiry, as machinery for checking municipal extravagance, is a farce. Even the newspaper in which the report of the inquiry appeared was shocked at the summary way in which the Inspector "smothered" criticism. Such doings amount to a scandal.

A remarkable fate has attended the various and sundry electric power schemes promoted in the present session of Parliament. It is understood that no opposition to Bills of this character on general principles will be favourably received. The Joint Committee of both Houses which decided in favour of the trial of experiments of this nature are responsible for a good deal of reckless speculation in these Bills, which continue to increase in number, though few of the schemes have much prospect of being carried out. Oppositions, in several cases, are allowed to drop; and the Bills go forward as unopposed measures. One such Bill, however, which was for providing the whole of East London and the Lower Thames district with electric power from three generating stations, proved too much for a Committee presided over by Mr. Cawley; and it was consequently thrown out. Yet there is more to be said for the merits of this particular scheme than can be sustained in respect to some that have received the sanction of Parliament. Its area of supply is the banks of the Thames constituting the Port of London—one of the busiest mercantile and industrial regions in the world. Unfortunately for the hopes of the promoters, they failed to enlist the support of the Local Authorities, all of whom—including the London County Council—opposed the Bill. Apparently all the Railway Companies and other statutory undertakers of public services also preferred the room of the promoters to their company. Notwithstanding the appearance of some local manufacturers to support the scheme, and the help afforded by several persons who professed themselves willing and able to assist the venture financially, there was about this aspect of the enterprise an evident weakness which was not lost upon the Committee. A plan for electricizing the Port of London could not be carried in the face of all the opposition arrayed against the Bill, or without the substantial backing which was not forthcoming here; and so the matter ended. Other instances are not wanting to indicate that the heyday of these speculative electric power schemes, without anything but the general hypothesis in their favour, is over. Enough of them for the purpose of experimental demonstration have been sanctioned; and it now remains for the provision of electricity in bulk to justify itself in fact. Unless this can be done, the chapter of their history in the United Kingdom will not run to much greater length than it occupies in technical literature in this Year of Grace, 1904.

FROM THE OHIO QUESTION-BOX.

[Second Notice.]

By way of example, we may make a short selection from the inquiries and answers found in the "Question-Box" of the Ohio Gaslight Association, as put into book form by the Editor (Mr. H. L. Doherty). Though the inclination is good, space and the pressure of current news compel this restriction.

In the section of the volume set apart for "Gas Manufacture," there are no less 114 questions, to each of which (with few exceptions) several answers have been subscribed. A large proportion of the questions relate to water-gas manufacture. We would suggest to Mr. Doherty that he should in future volumes subdivide the section as between water gas and coal gas manufacture. In this volume, the two are gloriously mixed up, and the classification would be of great assistance to the reader. The first question is on a matter that will appeal generally to the makers of water gas. "How much water gas tar," it is asked, "can be used in the water gas machine over the fuel bed as a partial means of enriching the gas?" The answers contributed show that one engineer on a 7 ft. 6 in. water gas set, employing 22 gallons of 28° gravity Texas crude oil, has used (by pumping the water-gas tar over the fuel bed in the generator) 5 gallons per run. So long as the tar lasted, he put 17 gallons of the above-mentioned grade of oil into the carburettor and 5 gallons of tar into the generator. Another answer is: About 20 per cent. of water-gas tar. With a 6 feet Lowe machine, ordinarily using 20 gallons of oil per run, and making 4300 to 4800 cubic feet of gas per run, the writer uses 16 gallons of oil and 4 gallons of tar. He advocates a separate tank and spray for the tar. About ¼ gallon of tar per 1000 cubic feet of gas made can be used, provided a blast pressure of 18 to 20 inches is employed on the generator, is the reply proffered by another contributor. He adds, if a lower pressure of from 12 to 15 inches is used, the fire will not get hot enough to vaporize the tar, and still get good results from the steam. A fourth answer does not contain favourable experience. This correspondent has tried cold water-gas tar, as well as heated and sprayed over the top of a Lowe generator, using Pocahontas coke for fuel. Although many efforts were made, and many analyses taken, he failed to derive any benefit, while the chequers of the carburettor were quickly clogged up with carbon. This was some three years ago. Apparently the previous replies refer to experience of more recent date.

Another question is this: "Is it better to alternate the running of a water-gas run while making gas, or is it better to make one entire up-run and then one entire down-run?" The experiences recorded in the answers are in agreement that the reply to the first portion of the question should be that it is not; but there is the variation in advice between two to six up runs being the proper practice to one down-run. It strikes one correspondent that reversing while the run is on would be aiming at a delicacy of operation that the knowledge of the conditions of the fuel bed would not warrant. To the question, "Is there any advantage in carrying a high boiler pressure for water-gas making, and wherein does this advantage lie?" the balance of testimony appears favourable to the high boiler pressure; the advantages being a dry high temperature steam delivered to the generator, the fire is kept in a better condition, the percentage of carbonic acid gas is lessened, a saving in generator fuel, dry steam for fuel gas, even pressure for the oil-spray, and a greater and purer make from each blast. Among the few who doubt the advantage of the high-pressure steam supply is found the Editor, who says: "The value of high-pressure steam is undoubtedly over-estimated. Steam at atmospheric pressure and 212° contains 1178·6 British thermal units; while steam of 120 lbs. boiler pressure contains 1220·4 British thermal units—the higher pressure steam only having 41·8 British thermal units more, or approximately 3½ per cent. more heat. Any practical advantage found in high-pressure steam must be due to the presence of less water in the form of water. Superheating the steam at atmospheric pressure, adding less than 100°, would more than compensate for the additional heat contained in the 120 lbs. steam, which would have a temperature of 350° Fahr., or steam at atmospheric pressure superheated to 312° Fahr. ought to be more desirable and advantageous than 350° steam at 120 lbs. pressure. It should be more economical to put this heat into steam in some other way than by generating heat in a boiler furnace, and transmitting it through the shell of the boiler to the water. I doubt if many boilers in gas-works yield an efficiency of 50 per cent."

On a further inquiry in connection with water-gas manufacture, there is also a division of opinion. "Would not split brick be better for chequer work in the carburettor and superheater than regular sized brick?" While the first contributor of a reply was decidedly of opinion that regular sized straight brick, when well burned, gave the best results in both carburettor and superheater, a second writer remarks that with split brick there would be twice the heating surface with the same annular space, and therefore twice as much oil could be used in the carburettor. A third correspondent goes into the matter very gravely. The question, it appears to him, demands knowledge of the ratio between total volume of gas passage and total volume of brickwork. Brick volume itself must be taken in connection with surface of brick exposed to the flow of gas, and the whole thing would hinge on

the particular oil to be used. As this latter is always variable, it seems to this correspondent that the only practical course is that already adopted, under which sufficient brickwork is provided to handle the heaviest oils at proper temperature, and provision for the handling of the lighter oils is made by regulating the temperature of the brickwork and the rate of the flow of gas. In the opinion of a fourth writer, split brick might do as well as the regular size brick in the superheater, but would not do at all as well in the carburettor. The fact that the first four or five rows on the top of the carburettor get badly broken up by the oil falling on them, would make it impracticable to use split bricks. He cannot see that there is anything gained by using them in either place, because, though the split-bricks are cheaper per 1000 than regular bricks, yet more must be used in covering a given area, making the cost in the long run greater for the split bricks, besides which they would have to be renewed more often than regular bricks. Nor are the other answers favourable.

We come across a question which has considerable interest. It is "What gas companies now use charging and drawing machinery?" There is only one reply to this; but it is of a detailed character. It appears from it that Ross machines are or have been in use at the following works: Boston, New York, Cleveland, Philadelphia (charging-machines only), Milwaukee, Ind. (drawing-machines only), and that Cincinnati carbonizes all their coal with this type of charging and discharging machine. Bronder machines are or have been in use at the following works: Consolidated Gas Company of New York, three charging at West 18th Street works, and two at East 14th Street works. Discharging at these works is performed by Ross machines. The Consumers' Gas Company of Toronto, three charging and three discharging machines. United Gas Improvement Company's Point Breeze Works, Philadelphia, three charging and three discharging machines. 25th Ward Works, Philadelphia, three discharging-machines. Ross charging-machines are in use at this works. Market Street Works, Newark, N. J., three discharging-machines. Mount Vernon, N. Y., two charging and two discharging machines. Montreal Company, two charging-machines. Worcester Company, Mass., two discharging-machines. Detroit Company, Mich., two four-tier charging-machines and two four-tier discharging-machines. Arroll-Foulis machines: Discharging machines in use at two works of the Cleveland Gas Company, also at the old Buffalo City Gas Company's Works, Buffalo, N. Y. "No West machines are as yet in use in the country, but are contracted for, and are being installed, at Milwaukee, Lowell (Mass.), and New Haven (Conn.)." It will be remarked in the reference to the Bronder machines that the correspondent speaks of four-tier machines, which means the charging and discharging of four retorts simultaneously!

A little farther on the attention is arrested by the inquiry as to "How many grains of sulphur in the finished gas can be considered permissible in good practice?" Opinions are unsettled; the answers quoting anything between 5 and 15 grains per 100 cubic feet, other than sulphuretted hydrogen. A question on a kindred matter has two replies to the effect that oxide of iron will remove all sulphuretted hydrogen from the gas; while a third reply attributes to it the power of removing "everything but the faintest trace of sulphuretted hydrogen."

A question is asked as to the depreciation of coal, and one experience recorded is that there is a loss of about 20 per cent. in coal which is stored for one year. At Detroit, it is found that deterioration is much more rapid at first than later, and that it is virtually limited to the gas occluded in the coal. On a like point raised farther on in the volume, it seems to be a fairly general opinion that, as depreciation decreases with time, it is better to use freshly delivered coal first rather than coal from store.

These are samples of the hundred odd matters dealt with in the section devoted to gas manufacture. But they are sufficient to indicate variety and value. A number of the questions are found to be entirely without answer; but they only form a small proportion. There is another point that it is a pleasure to notice—that it is not the simple everyday subject which gets the most attention, but that matters of higher standing are in many cases accorded considerable notice. And these again show not only a study of the questions and problems raised under practical and not merely theoretical conditions, but that many contributors have, their answers certify, a wide acquaintance with the published literature on the subject.

If the frequent references which have been made in our columns and elsewhere to radium should have engendered a desire on the part of any of our readers to know something about this remarkable substance, their wish may be gratified by the purchase of a little book, entitled "Radium, and All About It," which has just been published, at the price of 1s., by Messrs. Whittaker and Co., of White Hart Street, Paternoster Square. The author is Mr. S. R. Bottone, who has already shown his capability of dealing with the subject by his works on "Radiography" and "Wireless Telegraphy." In the little book under notice, he introduces his subject with a few historical notes, and then proceeds to explain the method of detecting and extracting radium and describes its properties; concluding with a chapter devoted to theoretical considerations. The text is illustrated by diagrams and several plates.

MR. THORNEYCROFT ON GAS-ENGINES.

THE open-mindedness with which Mr. J. G. Thorneycroft lately discussed the subject of the possible propulsion of ships by gas-engines of the ordinary character—that is to say, prime motors working with producer gas prepared as wanted for consumption—is greatly to the credit of this distinguished marine engineer. It has been recognized accordingly by competent professional opinion; while the same critics have nevertheless felt themselves called upon to point out that Mr. Thorneycroft has so far not even distinguished the special difficulties that stand in the way of the realization of a marine gas-engine, much less helped to overcome them. It is in respect to this same matter of the gas-engine that the gas industry proper, and gas engineering, finds one of its points of contact with mechanical and locomotive engineering.

Of course, the aspect in which the followers of the gas industry look at the gas-engine, is that of an appliance for consuming the staple product of the industry. Time was when the gas industry only made one description of gas, which was coal gas; and the only gas-engines known were such as used this product for their source of energy. At the present day things are changed on both sides. There are many descriptions of gaseous fuel to be had for the purpose of gas-engine working, and a great variety of motors adapted to all these various supplies of energy, in this general form. Spirit and oil engines must be included in the category. Still, the first interest of the gas-engine, for the gas industry, remains what it has been from the beginning of the success of the Otto motor. As a gas consumer, the economic range of the engine is plainly restricted; and it must be stationary. Though many attempts have been made, the use of ordinary coal gas in the portable way has never succeeded commercially. The gas-engine working with such gas is, moreover, bounded on the one hand by the producer-gas motor, and on the other by the petroleum-spirit engine. If producer-gas is the cheapest known source of motive power that can be manufactured for the purpose, not less is the "petrol" motor the most compact and concentrated form of prime mover made. The gas engineer, therefore, as he is classified in these columns, should look beyond his own particular ally in this form, and take an intelligent interest in what is going on just outside his own business province.

To consider briefly the spirit-motor first, it is a curious reflection that the successful working of this machine depends upon the manipulation of the apparatus—once peculiarly the gas engineer's own—known as a "carburettor." One does not know how far the attention of those who once used carburettors before anybody else knew of their existence, has followed the remarkable modifications of this appliance for the purpose now in question; but, really, it is very striking how thoroughly and completely the appropriation has been made. The details of petrol-engine carburettors are endlessly varied, and the ingenuity displayed in ensuring the proper composition of the vaporous mixture that has to ignite and do its work with lightning-like rapidity is truly astonishing. The spirit itself is so cheap, that the power derived from it comes well within the means of those who require its assistance for work or play, afloat or ashore—up to a point. Luckily, this point is inside the limitations of the road carriage and also of the harbour or river launch. Recently, moreover, petrol-engines have been put upon the market for isolated electric lighting plants, in which connection they are stated to be highly successful. They would, at any rate, not be strange to owners of motor-cars. In all this, the petrol-motor does not really compete with the gas-engine. If it has any rival, it is the oil-engine. Having regard to the amount of work it will do, petroleum motor spirit deserves to rank as the most concentrated of all known sources of energy. There is no danger of the spirit-motor running short of its proper fuel; for, if necessary, alcohol can be grown at prices almost comparable with that ruling for mineral spirit, and is quite suitable for the purpose.

The special domain of the producer-gas engine is rather difficult to define. No user of moderate power units who could obtain a reliable supply of ordinary gas at the prices prevailing throughout the United Kingdom, would preferably be troubled with producer-gas plant. Such plants, whether working by suction or pressure, require a special and expensive fuel supply, unless they are situated where small gas-works are not objected to. This condition also means plenty of ground space, which is not always available. The contemplation of the gas-engine as a marine motor brings out very prominently the differences between this kind of prime motor and the steam-engine. Assuming favourable conditions, it is possible to claim for gas power on the largest scale that it is the cheapest to generate, and quite sufficiently trustworthy for all practical purposes. Big gas-engines take less than 1 lb. of poor coal per indicated horse power per hour; and they will run for some months in succession without a stop. When this is said, however, there is an end of the superior advantages. Gas power-plant is no cheaper to install than reciprocating steam-engine plant, if it is not underbid by the steam-turbine. Gas power does not lend itself to variations of speed; and the engines are not reversible. The chief drawback, however, is the gas-producers. Mr. Thorneycroft has to admit that he knows of no such apparatus light enough, and in other respects suitable, for marine purposes. This settles the question of gas-engine power for ships, and indicates the gravest objection to the

big motor of the kind for land use. Lightness and compactness are not among the merits of gas-works; and where residuals have to be treated, the addition of a chemical works to the equipment does not tend to render the whole less objectionable, from the mechanical engineer's standpoint. Experience of the problem to be solved will be likely to convince the mechanician that gas manufacture is a business by itself, and is best managed by those who understand it. The great probability is that those who have most experience of producer gas will entertain the highest respect for the pure staple product of the regular gas industry.

FROM EARLY VOLUMES OF THE "JOURNAL."

Nov. 11 and Dec. 10, 1850.

THE Commissioners of Woods and Forests, acting, we should presume, on the advice of someone who had never tried a photometrical experiment on gas, prescribed for the use of their surveying officers a candle which none of them could use. Other parties have experimented with candles of wax, sperm, and stearine, consuming all quantities from 120 to 150 grains per hour; so that what may have given fifteen with one would only be twelve by another standard. This want of uniformity has led us into a series of experiments with the view of selecting the best standard, in the hope that we may induce the gas companies of the United Kingdom to adopt it universally, and thus allow gas engineers to speak the same language when discussing the illuminating power of the several gases. Our experiments have led us to conclude that a carefully made spermaceti candle, of uniform quality, with a plaited wick, consuming 120 grains per hour, fulfils all the necessary requirements; and some we have had expressly made for these experiments have not sensibly varied, either in the quantity of sperm consumed or in the intensity of the light given. We have taken measures to have a quantity of these candles made in a mould, stamped "Standard photometric candle."

The experiment which has been for some time past in progress at the Southport Gas-Works, on the manufacture of resin and water (or hydrocarbon) gas, has been watched with great interest by all parties connected with the manufacture of coal gas; and we have waited with some anxiety for the publication of the accounts of the Commissioners under whose authority the experiment has been made. The Treasurer's accounts have just been issued, extending from Nov. 12, 1849 (when the works were set in operation), to July 18, 1850; and though it is not easy to make up a profit and loss account from a treasurer's cash account, yet, with such further information as we have been able to collect, an approximate one may be formed, which will not be far from correct . . . It would appear from this statement that the hydrocarbon gas ought to be sold at Southport at 10s. per 1000 cubic feet to pay 5 per cent. interest on the money borrowed for establishing the works. It may be objected that this account is not credited with a large stock of valuable (?) products, such as resin oil, &c., which have accumulated during the nine months' operations. Some attempt has certainly been made to dispose of them, as we see £2 6s. 6d. credited from this source; but we maintain that, when twelve months have passed over without any market having been found for them, we are justified in considering the value set upon them as altogether fallacious and absurd. In fact, we are aware of an instance in the Midland Counties where a similar experiment was tried, and the products have remained for two years on hand, till in the end it became requisite to put a stop to their further increase by re-converting the establishment to a coal-gas works.

Mr. James Sharp, the intelligent Manager of the Southampton Gas-Works, delivered a lecture on "Gastronomy" at the Polytechnic Institution of that town on the 4th inst., before an assembly of 800 persons, of whom 120 afterwards sat down to a substantial supper, cooked by gas on the lecturer's table before the audience. The bill of fare contained: Roasts: 34 lbs. of beef, 15 lbs. of mutton, and 12 lbs. of pork. Boiled and steamed: 24 lbs. of mutton, a cod fish, four fowls, eight plum puddings, vegetables, &c., with baked pies and tarts. The whole had been cooked with an expenditure of 156 cubic feet of gas; the dripping collected being valued at 2s. The lecturer demonstrated the scientific principles upon which his apparatus was constructed and the heat applied; going into the theory of radiation, and showing how the greatest effect could be produced by the smallest consumption of fuel. The novelty of the evening's entertainment not only excited the intellectual and digestive organs, but gratified them at the same time.

Masonic.—A petition to Grand Lodge is now being prepared to permit the formation of a Lodge to be called the "Northern Star," to meet in Manchester, and to embrace members of the gas profession, on somewhat similar lines to the "Evening Star" Lodge formed in the London district more than a quarter-of-a-century ago. It is hoped that the petition will be completed in about three weeks' time. Bro. S. S. Mellor, of Northwich, is acting as Secretary *pro tem.*

OBITUARY.

We have learnt with regret of the death, on the 10th inst., of Mr. THOMAS LITTLEHALES, of Syracuse (N.Y.). The deceased was a not uncommon example of an Englishman leaving the Mother Country to find his life-work in one of her Colonies. He was born in 1843, and went to Canada in 1871 to take the management of the Hamilton Gas Company. This position he held till 1896, when he removed to Syracuse on obtaining a similar appointment with the Gas Company there. On this undertaking being amalgamated with the Syracuse Lighting Company, he entered the service of the Semet-Solvay Company, at whose office he was taken ill on the 29th ult., and succumbed to a complication of ailments. Mr. Littlehales was a member of the American Gaslight Association, having joined that body in 1874. He is survived by a widow, three daughters, and two sons.

By the death in London, last Tuesday, of Sir CLEMENT LE NEVE FOSTER, the Royal Commission on Coal Supplies, whose proceedings are being summarized in our columns, has lost a very valuable member. Deceased was the second son of Mr. P. Le Neve Foster, who for several years was Secretary of the Society of Arts. After completing his education in France, he entered the Royal School of Mines, where he had a brilliant career. He subsequently studied at the Freiburg Mining College, before leaving which he was appointed to the Geological Survey o Great Britain by Sir Roderick Murchison. This position he relinquished in 1862, in order to undertake certain mining explorations. On the passing of the Metalliferous Mines Regulation Act of 1872, he was appointed an Inspector to carry out its provisions. In 1890, he succeeded Sir Warington Smyth as Professor of Mining at the Royal School of Mines, and in 1892 the Royal Society elected him a Fellow. In 1894, he became Editor of the mineral statistics issued by the Home Office, and of the annual reports on the mines and quarries of the United Kingdom. He resigned his official position in 1901; and last year his services received the recognition of a knighthood.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 261.)

THE week just closed on the Stock Exchange has not been quite so radiant as its predecessor; and perhaps this was to be neither expected nor desired. A too sudden and too violent boom in prices is apt to have a similar reaction; and the higher the rise the bigger the drop. So the tendency was easier last week; and realizations brought prices down. But a firm feeling of general cheerfulness, coupled with a further fall in the value of money, kept the movement confined within small limits, and there was still a fair amount of investing at work. The Bank rate was somewhat unexpectedly put down on Thursday to 3 per cent. (the 3½ per cent. rate having lasted one week). The supply of money all the week was extremely abundant, and at times almost unlendable. Discount rates fell also, but were inclined to stiffen a bit before the close. The Gas Market had another very active week, though the bulk of transactions was perhaps even more closely confined to the large issues than in the preceding week. The general advance in prices continued in full swing, and extended to a number of undertakings which had not been reached in the first offset. But there are some sound companies not touched even yet. In Gaslight and Coke issues, the transactions in the ordinary were extremely numerous; and the figures marked daily were very steady. Once 92¾ was touched; but all other dealings were inside of 93-94¼. The secured issues were comparatively overlooked; but they ruled firm. South Metropolitan was less active, but a shade stronger; the range of prices being 123½-25½. No Commercials were touched but the debenture, which had a slight advance. There were some dealings in the less prominent issues of the Suburban and Provincial group. Many of them improved—viz., Brentford, Brighton, Crystal Palace, Hastings, Lea Bridge, and Tottenham. The Continental Companies were brisk, especially Union, which had a further recovery. Imperial rose also. Among the rest, there were advances in Bombay, Buenos Ayres, River Plate, and San Paulo. There was a revival of interest in the Water Companies, and many issues had a moderate advance; debenture stocks being prominently noticeable.

The daily operations were: On Monday, business was almost all in Gaslight ordinary and River Plate. Brentford new rose 3, Crystal Palace 2, Imperial 1½, and Bombay new and Buenos Ayres ¼. In Water, Chelsea and Southwark rose 2 each, and East London 1. On Tuesday, Union shared the business with Gaslight ordinary. Imperial debenture rose 1, and River Plate ¼. In Water debentures, Grand Junction, Lambeth, and Southwark rose 2 each, and New River 1. Wednesday was a quieter day. Hastings and both Unions rose 2 each. Thursday was steady; and the only movement was a rise of ½ in San Paulo. On Friday, there was more widespread activity. Lea Bridge improved 5, and Commercial debentures ½. Saturday wound up an active week with great firmness. Brentford rose 7, and both Brightons, Lea Bridge, and both Tottenhams 2 each. In Water, West Middlesex advanced 2.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Thirty-first General Meeting of the Association was held last Wednesday at Peterborough, under the presidency of Mr. J. H. TROUGHTON (Newmarket). The city is the birthplace of the Association, and a very convenient centre for a good proportion of the members. It has, in consequence, been the place of several meetings; and, judging from the number of members in attendance on Wednesday, they are far from tired of it.

The visitors assembled at the Grand Hotel shortly after noon, and a little later they were entertained at a light luncheon by the Chairman and Directors of the Peterborough Gas Company. The President introduced the Chairman (Mr. William Harris) to the members; but this was not the first occasion on which several of them had made his acquaintance. Few were his words of greeting; but they were expressed with heartiness and sincerity. Mr. Harris was accompanied by Mr. William Gaunt and Mr. J. T. Miller, two of his colleagues, and later in the day a third—Alderman Redhead—found an opportunity for joining them. After lunch, the President proposed, and Mr. H. Wimhurst (Sleaford) seconded, a vote of thanks to the Chairman and Directors; and the members acquiesced in the proposal with great cordiality. The Chairman, in his reply, wished the members a very prosperous meeting.

THE BUSINESS MEETING.

The Meeting was held in an adjoining room; and on the PRESIDENT taking the chair,

The HON. SECRETARY (Mr. T. A. Guyatt, of Ely), commenced the proceedings by reading the minutes of the meeting held at Newmarket on Sept. 16 last.

REPORT AND ACCOUNTS.

Proposed by Mr. F. LENNARD (London), and seconded by Mr. J. DAVIS (Gravesend), the annual report of the Committee and the statement of accounts were taken as read. The concluding paragraphs of the former were as follows: "The year commenced with a membership of 87. Three members have resigned, and three others severed their connection under rule 19. Seven new members were elected, making the total at the end of the year 88. The accounts for the year show that a balance of £37 15s. 6d. was brought forward, and subscriptions paid during the year amounted to £46 4s.—making a total of £83 19s. 6d. The expenditure was £36 13s. 7d., which leaves a balance in hand of £47 5s. 11d., and a few subscriptions outstanding. The question of affiliation of the Association with the Institution of Gas Engineers has been carefully considered by the Committee, and a proposal with respect thereto will be submitted at the forthcoming meeting at Peterborough. The Committee consider that the year has been a decidedly successful one, but papers are not yet forthcoming as freely as could be desired. The importance of this matter—more especially to the younger members—cannot be too strongly emphasized."

VOTE OF CONDOLENCE.

The PRESIDENT said his next duty was a melancholy one. It was to propose that a vote of condolence be sent to the widow and relatives of the late Mr. Palgrave Brown, of Southtown. Mr. Brown was one of the oldest members of the Association—in fact, he was one of the founders. He was a gentleman who had frequently attended their meetings, and had always lent his influence, and done all he possibly could, in the interests of the Association. He (the President) did not think he need say more; but he would ask those present to signify their assent by quietly rising.

The vote was passed, as suggested.

NEW MEMBERS.

The following gentlemen were enrolled as members: Mr. H. N. Clark, of West Ham; Mr. T. Goulden, of the Gaslight and Coke Company; Mr. F. H. Jones, of Westminster; and Mr. T. Stormonth, of Horncastle.

FROM THE PRESIDENTIAL CHAIR.

The PRESIDENT said, before proceeding further with the programme, he should like to say a word or two on the satisfactory condition in which the gas industry was to-day. While many industries were experiencing depression, it was most gratifying that theirs went on prospering, for not only were the sales of gas increasing almost everywhere, but the prices of residuals were well maintained. The cost of coal and of other commodities required in the manufacture of gas was approaching what might be termed normal conditions, after the iniquitous coal combination of four years ago, which paralyzed trade generally, and was doubtless responsible, in a large measure, for the depression in trade which had followed. It was a matter for congratulation to note the marked and definite advance which had been made in public street lighting by means of the incandescent gas-burner. Doubtless most of the members had read the interesting articles which recently appeared in the "JOURNAL OF GAS LIGHTING," entitled "The Public Lights of London," which gave a summary of the lamps then existing in London, as follows:

Electric arc lamps	4,974
Electric incandescent lamps	1,185
Incandescent gas-lamps	56,690
Flat-flame gas-lamps	18,248

Many of the flat-flames had since been converted to the incandescent gas system. To those of them who had been, or were threatened with electric street lighting, he would commend these articles, for they spoke volumes as to "the survival of the fittest." But notwithstanding this object-lesson, there were to-day some belated municipalities whose senators would not learn wisdom nor confine themselves to profitable trading, but instead persistently meddled with businesses that should be left to private enterprise, and who in consequence were blindly pawning their assets for posterity to redeem. The Industrial Freedom League had recently published a statement of the indebtedness of local authorities in the United Kingdom; and it showed that in the last eight years the municipal debt of the country had increased from £265,135,862 to £407,069,046—an increase of £141,933,184. This was another object-lesson. But he was a-wandering. He had congratulated them all on the past. Now he had to say that the prospects for the future were extremely hopeful. Science was constantly coming to their aid with new appliances; and with the view of bringing before the public the manifold advantages which could be obtained from the intelligent use of gas, an exhibition of an international character was being organized, to be held in London during the autumn of this year. In order that it might be a splendid success, they were all invited to help, by their interest and support, and by inducing their companies and corporations to subscribe generously to a guarantee fund which was to be formed. It was, however, a unique opportunity for gas to assert its superiority for effect and economy; and if liberal support and united aid were given to it, an unqualified success would be assured, to the mutual benefit of the gas industry and the general public. The exhibition was being promoted under the auspices of the Institution of Gas Engineers.

"THE PUBLIC LIGHTS OF LONDON."

Mr. F. LENNARD (London) said he should like to say in regard to the figures quoted by the President from the "JOURNAL OF GAS LIGHTING," as to the public lighting of London, that the figures for incandescent lighting included rather less than 1500 for the borough of Marylebone. But when the whole conversion was carried out, the figures would be something like 5000. So that really the figures for incandescent lights should be about 4000 more than the figures recorded.

The PRESIDENT: That makes it so much the better. It shows that the Municipalities of London are continuing to go in largely for incandescent lights rather than for electric lighting. That was the point I wished to bring out.

AFFILIATION.

The PRESIDENT, in opening a discussion on the subject of affiliation, first read the letter addressed to the Secretaries of all the District Associations by the Council of the Institution of Gas Engineers on Nov. 18 last year. This letter, he said, was carefully considered by the Committee of the Association, and afterwards a circular was sent out to the members embodying the views of the Committee. It would be seen that the Committee heartily approved of the proposal; and they gave the terms on which they were prepared to recommend the members to affiliate. [The circular was reproduced in last week's issue, p. 153.] Since this, the Special Committee appointed by the Institution to consider the question had met; and he, as the President of the Association, attended the meeting, which was a fairly representative one. As the result of their discussion, certain suggestions were made to the Council, who had passed the following resolutions:—*

(1) That the names of the District Associations be retained, and that the rules of each Association shall not be subject to revision or alteration without the consent of the respective members of it. That any member of a District Association not eligible to join the Institution shall have no claim to the benefits and privileges of the Institution.

(2) That the management of each District Association shall be in the hands of the Committee appointed by its own members, and the finances shall be under the control of that Committee.

(3) That each District Association shall select annually a member of its body who is a member of the Institution of Gas Engineers who shall become an *ex-officio* member of the Council of the Institution; and each District Association shall pay annually an affiliation fee of five guineas.

(4) That members of each District Association (who are qualified to become members under the Articles of Association of the Institution) shall be eligible for election to the Institution without entrance fee for a period of twelve months after affiliation.

* These resolutions are practically the same as the copy published a fortnight since (p. 73); but as there were a few verbal alterations made in them before being sent out to the District Associations, they are given here in their revised form.—ED. J.G.L.

This, the President added, was as far as they had got; and he now invited the members to discuss the matter in its entirety. It would then be possible for the members to adopt or reject the proposals the Committee had made.

Mr. R. G. Shadbolt (Grantham) asked whether it was proposed that the members should accept or reject the recommendations of their own Committee *en bloc*, or whether they should be discussed and voted upon separately.

The President replied that this was just as the members wished. If there was any point in any of the paragraphs upon which members desired to raise any question, he should be glad to hear what they had to say.

Mr. Shadbolt said the only point he wished to raise was this, that their own Committee's recommendation No. 4 said: "The President of the Association shall be an *ex-officio* member of the Council of the Institution during the term of his office, provided his qualifications entitle him to membership of the Institution." He had just this passing thought, that in the event of their President not being qualified for membership, they would not be represented on the Council of the Institution.

The President pointed out that clause 3 of the Special Committee's report set that matter right. By this, in the event of the Association having a President any year who was not a full member of the Institution, they would have power to elect a representative who was.

Mr. Shadbolt pointed out that they were binding themselves to something in their own Committee's recommendations which was not to their advantage. Why not, he asked, put the matter right by making the recommendation accord with the one submitted by the Institution Committee? That was the only suggestion he had to make.

Mr. John Carter (Lincoln) remarked that he offered the suggestion, with due diffidence, that they would probably be getting on with the business a little more quickly, if it commended itself to their judgment, to take the views of the meeting direct upon the proposals of the Council. If members were favourable to the conditions laid down by the Council, this would dispose of the question immediately.

The President said that, following up this suggestion, he also thought they might confine themselves to the proposals of the Special Committee; and he would take them separately.

Mr. Wimhurst inquired whether it would not be advisable to take a vote of the meeting first as to whether or not it was desirable to affiliate with the Institution. He, for one, should say that it was very desirable; and he would propose that the Association should become affiliated.

Mr. J. T. Jolliffe (Ipswich) thought that before the members decided to affiliate with the Institution, they should know what they were affiliating with, and on what basis they were affiliating. With all respect to Mr. Wimhurst, if once they agreed to affiliate, the thing was finished.

The President said his own original idea was that they should go through the recommendations of the Special Committee, and, after Mr. Jolliffe's remarks, he thought that this was probably the best course.

Mr. E. W. Smith (Chelmsford) said it seemed to him that what they ought to discuss was the general question whether it was desirable to affiliate with the Institution, and leave the consideration of the details to a future meeting. There might be several matters crop up which would need to be settled; and he was certainly of opinion that they need not pledge themselves to all these recommendations at the present time.

The President pointed out that there were only four recommendations; and they must consider the terms upon which the Institution were prepared to affiliate.

Recommendations Nos. 1 and 2 were then put, and agreed to.

On recommendation No. 3,

Mr. Wimhurst said it had struck him, in connection with the annual affiliation fee of five guineas, that a small Association like their own should not be called upon to pay the same as the Midland, Manchester, and other wealthier Associations.

Mr. W. D. Child (Romford) asked why the Association were to pay this fee. Each member who was a member of the Institution would pay his own annual subscription, and so he could not see why the Association should pay this further fee.

The President explained that it was a small amount, which had been arranged as the minimum, to cover the expenses of the representatives to be sent by the Associations to the Council of the Institution.

Mr. Carter said that probably some explanation was due as to why the idea of the inevitable selection of the President as representative had been dropped, and the proposal of the Council substituted. It was simply to leave each District Association with greater liberty of selection than such a clause as their own Committee's would have allowed. It might be that occasions might arise when, for various reasons, a District Association might elect as a representative some gentleman other than the occupant of the chair for the time being—if they chose to avail themselves of the option. The rule suggested by the Council would leave them free in the matter.

The third recommendation was agreed to. Upon the fourth,

Mr. Wimhurst said he did not like the limitation of twelve months to the remission of the entrance fee to the Institution for members of the Association. It meant that anyone becoming a member of the Association after one year would not be eligible to become a member of the Institution without paying the entrance fee. This, in his opinion, was rather a hard rule.

The recommendation was agreed to.

Mr. Smith said he did not know whether this was the proper time and place to discuss the question of the Institution fees. But it occurred to him that there might be many managers of small works who were members of District Associations, and who might not perhaps be able to pay the ordinary annual subscription to the Institution. He had been wondering whether the District Associations would be able to exercise any influence in making the subscription easier. He supposed it was a fact that not more than half the members of the District Associations of the United Kingdom were members of the Institution. Probably one reason for this was the amount of the subscription.

The President said the question raised was entirely one for the Committee of the Association to deal with afterwards whether or not they agreed to affiliate. He would now formally move—

That the Eastern Counties Gas Managers' Association agree to affiliate with the Institution of Gas Engineers on the terms of the resolutions of the Council.

Mr. Wimhurst seconded the motion, which was passed with three dissentients.

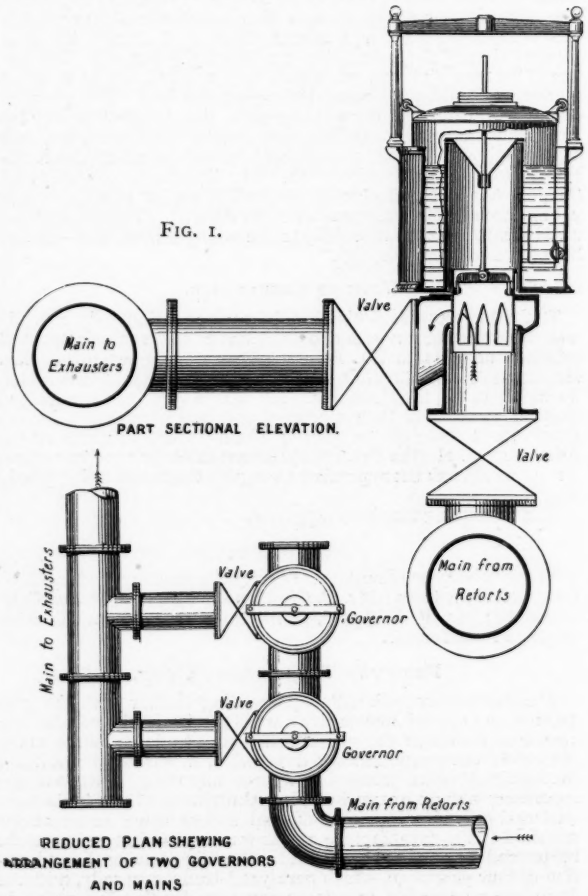
The President said the Committee would endeavour to carry out the vote to the best of their ability, and would safeguard the interests of the Association so far as possible and consistent with the recommendations which had been laid before them that day.

Mr. T. Glover (Norwich) read the following paper, entitled—

SOME THOUGHTS ON THE REGULATION OF PRESSURE.

A wise man is reputed to have said that "of making many books there is no end." The writers of books in the ordinary sense have the advantage of those who write papers on technical subjects, inasmuch as they are able to draw on the imagination, and thus obtain a fair amount of latitude not possible to those who must write on plain technical facts. It is nevertheless true that, in the writing of technical papers in connection with our own industry, there is no end; and this is at once a tribute to its many-sidedness and its constant progress. The present writer is not in a position just now to ask your attention to a description of anything very fresh or interesting; but he recognizes the difficult position in which the Secretary must sometimes be placed in providing papers, and he has endeavoured, as a member of the Association, to do his duty in bringing under your notice his experience in exhausting gas from retorts under somewhat un-

FIG. 1.



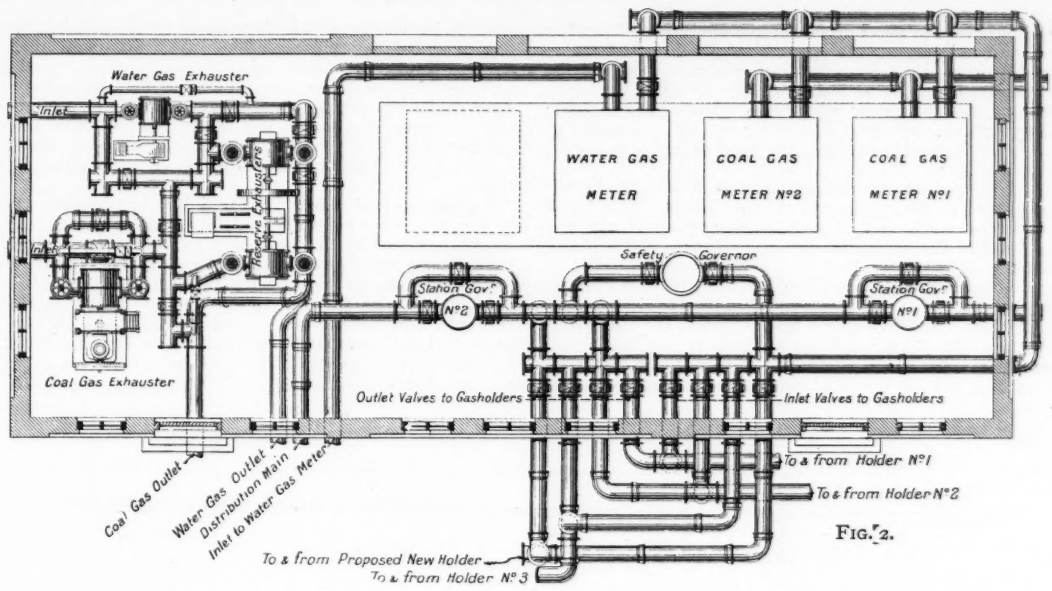


FIG. 2.

usual conditions, and some thoughts on the regulation of pressure on the district.

Pressures on retorts and pressures on distributing mains and consumers' premises are subjects which apparently have little relation to each other. How they came to be associated in the writer's mind in looking for matter for the purpose of this paper is explained by the fact that he has recently installed governors for regulating the exhaust or pressure on a new installation of retorts, a new arrangement of district governors and distributing mains, and has been interested in the question of the pressures most useful on consumers' premises, and has had a number of experiments made to ascertain what pressures usually obtained. As a result of these experiments, he has been impressed with the importance of uniformity in pressure, if the consumer is to obtain the highest efficiency from the gas he consumes.

Governors have been used on the foul mains between the exhausters and the retorts by one or two London Gas Companies for some years. Knowledge of this practice—first brought under the writer's notice by Mr. Charles Carpenter, the Chief Engineer of the South Metropolitan Gas Company—was most useful to him when he was in the awkward position of having to work a new bench of retorts without seals requiring 1-10th back-pressure alongside of old benches requiring $3\frac{1}{2}$ inches of vacuum connected to the same exhauster. Two 12-inch Cowan governors, with inverted Key's valves, were fixed on the water-gas floor, adjoining the retort-house; one governor only being in use at a time for a period of a fortnight. The other, being idle, would have its valves cleaned free from any thick tar which might accumulate in the gas-ways. The design of the governors allows this to be readily done. (See diagram No. 1.) This arrangement for these special circumstances answered admirably. The governors are now being used with equally good results, under other conditions, also unusual and possibly interesting.

The Norwich works occupy two distinct sites. The carbonizing and water-gas plant, with the condensers and scrubbers, occupy one site; while the exhausters, purifiers, meters, holders, and governors are on another site—the two parts of the works being connected by about 1000 yards of high road, along which the foul mains are laid. Without the use of governors, it would be impossible to maintain a steady and reliable exhaust on the foul mains in the retort-house. The pressure chart No. 1 [See p. 222] shows how perfectly this may be done by their use. To ascertain the pressures prevailing inside a retort working without hydraulic seal, and with the pressure steadily maintained at zero on the foul mains, a six hours record was taken; and the result is shown on the enlarged pressure chart No. 2.

When we consider what a porous vessel an ordinary fire-clay retort is, the importance of relieving it of any pressure from the gas being made, is apparent. It is equally important, if any regard is paid to quality, that there should be no suction; otherwise furnace gases are readily drawn in and illuminating power is rapidly destroyed. An arrangement of governors, such as that now described, is a valuable adjunct in a gas-works; giving the engineer relief from worry as to hydraulic seals being overcome, or as to undue pressure causing loss by leakage through the porous walls of the retorts.

The second part of this paper has to do with district pressures and pressures on the consumers' premises. The alterations and extensions at the Norwich Gas-Works have included the instalment of new district governors, with additions to the trunk mains and a new system of valves for operating the gasholders; the general arrangement being shown on Diagram No. 2. The new governors are of the Parkinson equilibrium type, with a simple, but very effective, water-loading arrangement. The two new governors have displaced three of an old type.

One of the old governors has been retained for use as a safety governor, and is so weighted as to come into operation if the pressure from the holders should for any reason be insufficient to keep the ordinary governors supplied. It will be noticed that the gasholder inlet and outlet valves are all in line. They are provided with standards and indicators showing at a glance the holder into which the make is being sent, or from which the city is being supplied. This grouping of the values has been made possible within the area occupied by using one line of pipe alternately as inlet and outlet; it being the rule to work into one holder and out from another. The advantage of such an arrangement will be readily understood.

The merits of water-loaded governors are probably known and appreciated by most of the members of this Association. The evils arising on the district from the sudden changing of pressure are avoided with this system. The loading or unloading can be readily arranged at any desired speed. On the question as to what is a suitable pressure to maintain on the district mains, there is no doubt a variety of opinion; and local circumstances must decide the matter in every case. Probably it is not far from the truth to say that the gas engineer's chief anxiety during the recent times of rapid development where the fuel and slot business has been cultivated, has been to give all consumers sufficient, without incurring an undue expenditure on enlarging mains. A rough standard of duty to our consumers in this respect has been "to give them plenty," and to regard this as the end of the suppliers responsibility.

It has become the fashion lately to despise the old rule to keep down the pressure in order to reduce the leakage account. No doubt many defects may be covered by high initial pressures; but the writer is of opinion that wide fluctuations of pressure on the district mains, more particularly at the consumer's burners, are of much greater consequence than the avoidance of pressures which may be called low, if they are steadily maintained. High pressures undoubtedly lead to wasteful consumption; and wasteful consumption is not conducive to sweetness and confidence in the relations between consumers and suppliers. A contented consumer, although a moderate one, is of more permanent value than a reckless one, who suddenly finds out that he is being ruined by his light and fuel accounts, and orders the meter to be removed. If high-pressure feeder mains are found to be an advantage for delivering a large volume, at small outlay in mains, to distant parts of the distributing system, it is the writer's opinion that the initial pressure at which such mains are supplied should be automatically regulated to the demands of the district that they are intended to serve.

In this connection, it may be remembered that an ingenious system of automatic pressure regulation from a distance, devised by Mr. William Cowan, was clearly described by the late Mr. Chester, in a paper read by him before the Gas Institute in 1897.* By electric communication from a pressure vessel fixed in a distant isolated district, the water loading of a governor supplying this particular district was done so perfectly as to give a straight line on the pressure chart. Some adaptation of this system might easily be made to start and stop the motor necessary to give greater pressure than the holders will throw, if such pressure was needed, for feeder mains, or it may be that the pressure on the feeder main might act as a means of automatic communication for starting or stopping the motor used for supporting the pressure in a distant part of the district.

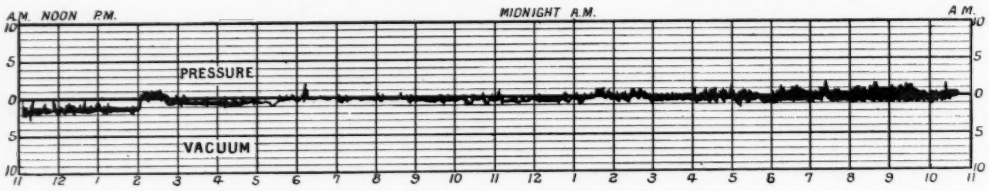
Even without the increased liability to undue fluctuations which will follow the use of high-pressure feeders, unless automatically controlled from the district they are intended to supply, it is

* See "JOURNAL," Vol. LXX., p. 26.

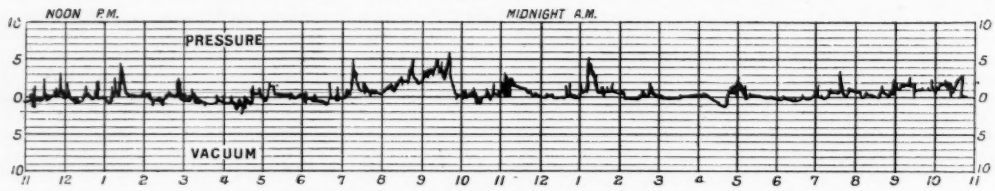
worth noticing what the effect of the simple operation of putting on the pressure may be on the consumers' stoves and burners where the supply is taken from the trunk mains. The portable pressure recorder is a valuable instrument for revealing the variations in pressure which occur in different parts of the district; and the diagrams thus obtained frequently indicate room for improvement if a consumer is to obtain the most satisfactory results from the gas he burns.

Starting at the governor outlet, pressure chart No. 3 indicates the initial pressures during the twenty-four hours. At a short distance from the works, but at an elevation of about 100 feet above the level of the governors, we get pressure chart No. 4, taken from a consumer's service; and at the same place, but at the outlet of a mercurial governor, fixed on the consumer's meter, we get pressure chart No. 5. It is found that the steady pressure shown on the last chart is of much more value to the consumer, both for heating and lighting. Some of the best results from incandescent burners for lighting interiors have been obtained with pressures of 8-10ths; the burners being quite noiseless—a result not obtainable where a high pressure is reduced by an ordinary tap near the point of ignition. Gas fires and cookers are frequently used in a wasteful fashion by inexperienced persons, and any increase of pressure above that for which the burner jets were made will rapidly increase the liability to wastefulness, as the accompanying tables will show. Complaints of excessive charges usually follow the first quarter's use of stoves, unless some automatic pressure-checking appliance is fixed at the same time.

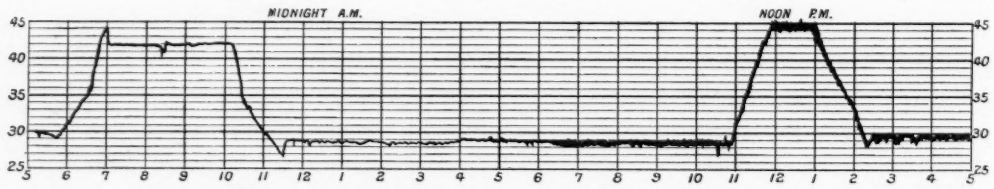
During the past winter in Norwich it has been the rule to fix on every new fire supply a metallic governor having a maximum capacity suited to the best duty to be obtained from the fire, unless a mercurial governor was already in use; and on every new installation of gas for cooking or heating of any importance, especially where the gas appliances are under the charge of servants, consumers are advised as to the advantage of using mercurial governors, and these are fixed with the meters. It may be advisable in the future to hire these governors, as we now do meters, charging the meter and governor rent together.



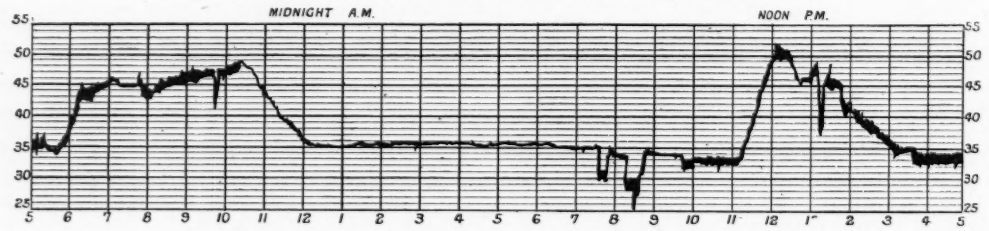
Pressure-Chart No. 1.—Retort-House Governor Outlet.



Pressure-Chart No. 2.—Taken from Retort Mouthpiece.



Pressure-Chart No. 3.—Station Governor Outlet.



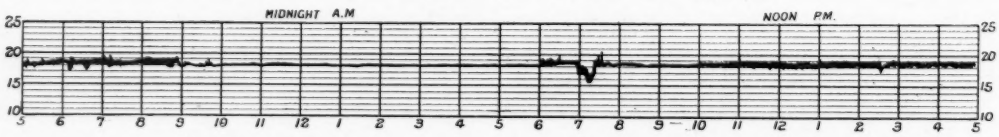
Pressure-Chart No. 4.—Inlet of Consumers' Governor.

Pressure-Chart No. 5.—Outlet of Consumers' Governor.

Table Showing Consumption of Gas by a 12-inch Interior Fire Burner at Various Pressures.

Pressure at Fire. Tenths.	Consumption per hour. Cubic Feet.	Report.
8	31·00	Burning quietly, flame not visible on top of fuel.
10	34·50	Flame just visible on top of fuel.
12	37·75	Tails of flame above fuel at the back of the fire.
14	40·75	Flame 1 inch above fuel all over.
16	43·50	,, 3 ,, ,, ,, ,,
18	46·00	,, 4 ,, ,, ,, ,,
20	48·25	,, 6 ,, ,, ,, ,,
25	54·00	,, 8 ,, ,, ,, ,,
28	57·50	,, 10 ,, ,, ,, ,,

Table Showing Consumption of Gas by a Fletcher No. 140 Cooking Stove at Various Pressures.

Pressure in Tenths.	Consumption per Hour. Cubic Feet.		
	Oven.	Grill.	Boiling Burner.
8	22·00	26·00	10·0
10	25·25	28 75	12·0
12	27·50	30·50	12·5
14	30·25	35·00	13 5
16	32·50	36·25	15·0
18	34·75	39·00	15·5
20	37·50	40·25	16·5
22	40·00	42·50	18·0
24	41·50	45·00	18·5
26	44·00	47·50	19·5
28	49·00	49·00	20·0
30	46·00	52·00	21·0

Concluding this somewhat fragmentary paper, prepared at a time of stress of much important work, I might anticipate the objections which may reasonably be raised to the latter portion of it—that it is no part of our duty to teach consumers how to economize. I would say that it is only on the lines of the new spirit which during the last decade has pervaded the administration of many gas companies in their dealing with their consumers—a spirit far removed from the old arbitrary treatment which often made enemies and created an atmosphere of suspicion and distrust. The days of competition, as they are known to many of us, are trying as compared with the days of monopoly; but even in the towns and cities where competition is keenest, the supply of gas is still one of the most important of the public services, and will remain so all the more secure where efficiency is the watchword, especially in that part of the business which most directly affects the consumer.

I desire to acknowledge the ready assistance given by Mr. Moon, Mr. Wayte, and Mr. Phillips, three members of my staff, in carrying out experiments, and the preparation of the diagrams in connection with this paper.

Discussion.

The PRESIDENT said the members had heard a very interesting paper on an important subject to the profession, both in regard to their works and district, and, even further than that, in regard to their consumers, in the way they used the gas. He hoped there would be a good discussion.

Mr. W. D. CHILD said he did not wish to be hypercritical in his remarks on Mr. Glover's paper. The author had raised the question as to the pressure that should be given to the consumer. He (Mr. Child) thought this was determined by the pressure which was necessary in the daytime when the mains were at their best capacity for supplying. Then any question of raising the pressure came to this, as to what was necessary to maintain in a district at night time the same supply that was given to the consumers in the daytime. He would put it in another way: The consumer required no higher pressure at night than he did in the daytime; but it was necessary to give a higher initial pressure in order that the consumer might receive the same pressure at night (when there was a great draft on the mains) that he did in the daytime when there was scarcely any draft at all. Mr. Glover had not, he thought, been very happy in one paragraph. He wrote it in this way: "No doubt many defects might be covered by high initial pressures; but the writer is of opinion that wide fluctuations of pressure on the district mains, more particularly at the consumer's burners, are of much greater consequence than the avoidance of pressures which may be called low, if they are steadily maintained." This was not very clear; and he (Mr. Child) confessed that he did not know exactly what Mr. Glover meant. He took it that the whole question of the government of gas pressure was the desire to ensure an equal pressure to the consumer at all times of the day and night. Take, as an example, his own case. In the distribution of gas at Romford in the old part of the town, which covered some 10 miles of main, they were enabled to supply the whole district in the daytime with 20-10ths, ensuring to every consumer in the district 15-10ths pressure for any purpose. It was only necessary to raise the initial pressure 5-10ths to secure the same pressure all over the district at night time. But, in a more residential part (where the mains were extending and called for enlargement almost monthly, and they had something like 17 to 18 miles of mains), they had to give an initial pressure of 45-10ths to ensure 10-10ths at the extreme part of the district. This was an undesirable state of things, which no one would endeavour to uphold. A governor assisted them to keep the consumer at the further end of the district as well supplied as possible; but it all pointed to an undesirable state of things, which must be altered by the rearrangement of mains at the earliest period. So far as any fluctuation of pressure caused by wind on the holder was concerned, he should like to make one remark on that point. During last winter, they had some high gales of wind in the district; and he noticed the action of the holders on the initial pressures. While the column-guided holders were causing a variable initial pressure of 4-10ths to 5-10ths, the spiral-guided holder recently erected did not cause a variation of 1-10th. This spoke volumes for the steadiness of the pressure given by the holder guided on that principle, as against one guided by columns, unless the greatest care was taken not only with the top but with the bottom rollers.

Mr. J. H. BROWN (Nottingham) thanked Mr. Glover for his paper, and said it was of particular interest to him at the present time, seeing that he was at the moment reconstructing a rather elaborate and antiquated system of governors at the Basford Gas-Works, Nottingham. Mr. Glover incidentally also mentioned Mr. Cowan's patent electrical water-loading system for attachment to governors, which was at work at the Eastcroft and the Giltbrook works. They were supplying a district some five to seven miles from the gasholders; and it was necessary to maintain from 5 to 7 inches initial pressure at the governor, in order to ensure 2 inches at the point of supply. This arrangement had been in regular use during the last six or seven years; and it had worked admirably—in fact, they got an absolutely regular pressure gauge, quite as regular as that shown on chart No. 5. The great difficulty, however, was to maintain the electrical wires in proper working order. It necessitated two positive wires and a negative wire; and very often in stormy weather, in the length of five miles, they had three or four posts or lengths of wire down. It had become a question whether it would not be advisable to go back to the old state of affairs, with a governor water-loaded or loaded by hand, instead of having this electrical method, with its expenses for maintenance and wayleaves for posts and wires. With reference to the system shown on drawing No. 2, he noticed that Mr. Glover only had one pipe for both the inlet and the outlet for each holder. Was not this to a certain extent a disadvantage? At the Basford works he was now removing an old system of governors. It was the original system erected before 1845. It had continued in use until this last winter, when it was found that the fall in pressure between the gasholders and the governors was twice as great as the fall in pressure between the governors and the farthest consumer; and it had now become necessary to reorganize the whole distribution system. Mr. Glover showed one pipe supplying two governors of the same size as the supply-pipe. He (Mr. Glover) would probably reply that the pressure in the inlet-pipe was perhaps three times that of the outlet-pipe. If, owing to greatly increased demand, he had to maintain an inlet pressure of 5 to 7 inches (which was quite normal nowadays), this arrangement would then probably need reorganization. If, in place of the single pipe, Mr. Glover erected a cast-iron box of twice the size of the original main, he would find that no rearrangement would be necessary, however great the demand became in after years. In the course of the paper, Mr. Glover also said: "It will be noticed that the gasholder inlet and outlet valves are all in line. They are provided with standards and indicators showing at a glance the holder into which the make is being sent, or from which the city is being supplied." In building the new governor-house on very similar lines at Nottingham, he found that it would be advisable to have some clear indicator to show which gasholder was being used; and they had the choice of many valves. In the end, they decided to use Walker's outside rack-valves, with a long rack standing 2 feet above the top of the valves when open; and these had been used on that account, and because of their accessibility. Anyone coming into the house could immediately see at a glance which gasholder was being used.

Mr. E. W. SMITH (Chelmsford) asked Mr. Glover if, with a small inlet-pipe to the bell of the new Parkinson's governor, he did not think there would be greater liability of the pipe choking, and thereby exhausting the bell of the gas.

Mr. A. E. BROADBERRY (Tottenham) said that the previous speakers had not referred to the retort-house governor Mr. Glover had described. He (Mr. Broadberry) certainly thought that this was an important piece of apparatus, as they all knew the disadvantages that they suffered from the inequalities of the pull on the retorts. He had indeed been so impressed with the excellent results of this governor on a vacuum that he had determined to introduce it in the alterations he was making at their works at Tottenham at the present time. The arrangement Mr. Glover had illustrated showed two governors; but he (Mr. Broadberry) believed it might be extended—three or more governors might be worked, according to what was required for the time being; one governor always being held in reserve for cleaning. He himself believed it was undesirable that these governors should be of any large size—mostly, he thought, they were about 8 inches; and if a larger pipe was required, it was produced by adding on more governors. The reason for keeping them small was to facilitate the cleaning; as, one naturally saw, they were liable to be choked by tar occasionally. On the subject of the combined inlet and outlet pipe for the holders, Mr. Glover said that one could readily see the advantages. He, however, must agree with previous speakers that he did not readily see the advantage of having the combined inlet and outlet pipe. On the contrary, he found it an advantage to have a separate inlet and outlet pipe. If at Tottenham it happened one morning—say, Monday morning—after shutting down on Sunday, that they found the quality of the gas had fallen, that they were pretty near or positively below their standard, their system was to at once improve the quality of the gas by working in and out of one holder so as to ensure the supply of a good quality of gas on the district. Then, as the make got richer, they gradually let back some of the poorer gas from the other holders, so as to ensure being above the standard. He did not see how Mr. Glover would be able to do this with the arrangement that he had shown on the plan.

Mr. GLOVER, in replying to the discussion, thanked the members for the way in which the paper had been received. As to Mr. Child's remarks, he was sorry the paragraph to which he had referred was not quite clear. He was in perfect agreement with Mr. Child that wide fluctuations on the distributing-mains were undesirable, but more particularly were these fluctuations undesirable on the consumers' burners. Fluctuations on the trunk mains were in many cases unavoidable; but he had pointed out how uniformity of pressure might be obtained by the use of mercurial governors on the consumers' premises. It was very interesting to hear from Mr. Child that no fluctuations were recorded on the pressure chart due to stormy weather when the Gadd and Mason holder at Romford was supplying the town. It was certainly a common experience with holders with ordinary guide-framing that a certain amount of oscillation was shown on the sheet during the prevalence of high winds. Mr. Brown had given them some interesting information in regard to the Cowan system of regulating pressure from a distance, and confirmed the

statements he had made as to the efficiency of this system. It was disappointing, however, to hear that, through the trouble experienced with the electrical connections, there was some doubt as to the use of the system being continued. With regard to the use of one pipe acting alternately as inlet and outlet—a question also raised by Mr. Broadberry—the system he had described allowed for the working in and out of the same holder whenever this was necessary, or for the use of more than one holder on to the town so long as the holders balanced. There was nothing to be gained in the way of increased capacity to the governors by the use of two pipes, as one would be idle as a delivery main. The use of one pipe instead of two effected a considerable saving in first cost, and enabled the engineer to have the valves close together, and in line, for convenience and safety in working. He thought Mr. Broadberry must admit that there were advantages in such a system, although, for the special circumstances Mr. Broadberry had described, one pipe might not be as advantageous as two. He recognized that the paper might not be regarded as a high-class one. It was on a commonplace subject; but he thought that any paper, however poor, served the purpose of the Association better than the "Question-Box," as used in some of the American Associations, and which had been recommended as a way out of the difficulty of providing suitable papers.

Mr. J. S. Dougall (Boston, Lincs.) on

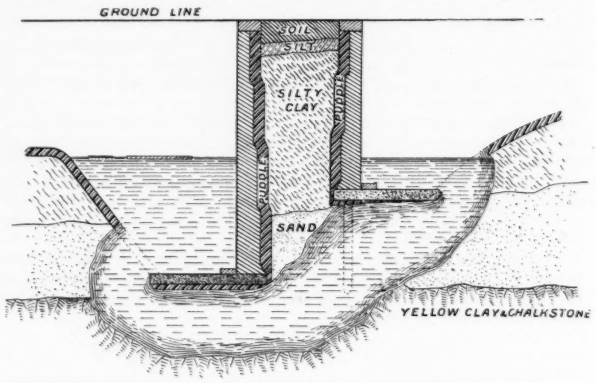
AN EXPERIENCE WITH A BURST GASHOLDER TANK.

A few years ago it became necessary to increase the storage capacity at my Company's works. Our largest gasholder was a single-lift one and thoroughly worn out. It was built in 1859. It was recommended that the old holder should be cut out and replaced with a telescopic one, which would about double its capacity and bring up the storage to our maximum day's requirements.

The contract having been settled, the work was begun at the most favourable time of the year—the early spring. It was specified that the tank would be emptied of water and refilled by the Gas Company. We had excellent facilities for so doing—a large brick pond being close at hand. A portable engine and pump was hired, and the work of emptying the tank was proceeded with. The pumping had to be done very cautiously, as a space of only 4 feet separated this tank from the other—the gasholder of which, with another small one, we depended on for the supply of gas to the town. I had no plans to refer to as to the construction of these tanks. As a precautionary measure in case of any leakage through the brickwork of the adjoining tank as the work of emptying proceeded, a stack cover of 18 ft. by 20 ft. was let down with two scaffold poles at each end.

The dimensions of the two tanks are 86 ft. diameter by 24 ft. deep, and 72 ft. diameter by 15 ft. deep. When we got the water below the bottom of the shallow tank, we proceeded very slowly with our pumping until only about 5 ft. depth of water remained in the large tank. We left it like this for a few days and all seemed to go well, until one night about 9 p.m., one of my men heard a loud rumbling noise and went to see what was the matter. He was alarmed to see the adjoining gasholder disappearing quickly in the ground. The man quickly informed my foreman, and he summoned me at once on the works; and as soon as I realized what had occurred, I ordered our smallest holder to be turned on the town and the other shut off. We were just in time to save the town from darkness. Thus suddenly deprived of our main stock of gas for the night, our difficulties commenced. We had now to keep up the town's supply through our smallest holder, which held only 20,000 cubic feet, and had a 6-inch inlet and an 8-inch outlet pipe. Difficulties of pressure occurred; but fortunately a few years before I had a 12-inch safety bye-pass governor put down, and this helped us a good deal. We kept the town fully supplied with gas with this small holder by the aid of the bye-pass governor. Our make at the time of the accident would be about 130,000 cubic feet per day.

Next day, on examining the situation of the sunken holder, I found that no gas was lost; the water in the tanks had come to a common level, and was of sufficient depth to form a seal. My next thoughts were to raise the gasholder. I required all the gas the holder contained for the next night's consumption. With the aid of a portable engine and powerful pump, also the fire-engine belonging to the Great Northern Railway Company, kindly lent me by their District Engineer, we pumped the water back into the tank until we raised the gasholder and got the use of the gas it contained for the night. We continued to work this holder for a fortnight, until the contractor required the tanks emptying again. The holder being then thrown out of use, an examination of the tanks was made to ascertain what had occurred. A few plates were cut out of the top of the holder, and, on descending into the tank, we found that the burst had taken place underneath the walls of both tanks, as shown on the diagram. The tank walls were not damaged; there was a hole about 5 feet in diameter where the water had rushed through and driven a lot of piles with it. We found that the small tank had been piled all round where the tanks closely adjoin each other. To repair the hole made, several loads of cement concrete were first put in, and then several loads of ground clay were well rammed in at the back of that, until the hole was filled up. This made a tight job of both tanks. The tank and holder were out of use for about six weeks, during which time we continued to keep up the town supply through our smaller gasholder of 20,000 cubic feet capacity. Our daily make of gas during the six weeks would average 100,000 cubic feet.



The work of cutting out the old holder and replacing it with a new one was not delayed through the mishap with the tank. The contractor had to do all the work in three months, and it was done a few days within the specified time.

This short narrative of what occurred a few years ago (written under great pressure for time) will, I hope, interest members who may possibly, in the future, be placed under similar circumstances.

Discussion.

The President observed that the members had had Mr. Dougall's interesting experience; and he hoped those of them who had had any experience on similar lines, or anything appertaining to it, would contribute it.

Mr. R. G. Shadbolt (Grantham) remarked that Mr. Dougall's experience was one which certainly did not fall to the lot of every gas manager. He had had no personal connection with such an experience; and he hoped he never should. The nearest approach to it that he had had a hand in was the sinking of a deeper tank in close proximity to a shallower one. In this case, the difficulty was caused through the action of running sand; but as the tank was a cast-iron one, and the running was checked in time, no material damage was done. The way in which Mr. Dougall had dealt with the situation was an admirable one; and he thought the people of Boston were to be congratulated on having an Engineer who could provide them with a sufficient supply of gas without apparently any cessation under such trying conditions. One could not help wondering whether any settlement had taken place since, or whether Mr. Dougall had had any trouble since that time. He supposed he had not, or he would probably have made a note of it in his paper. There was not much in the paper the members could discuss; but he could assure Mr. Dougall of their great sympathy with him at that particular period. It must have been a very trying time; and it was at such times that the stuff a man was made of was put to the test. He congratulated Mr. Dougall on the manner in which he came through it.

Mr. Arthur Graham (Mansfield) said that some twelve or fourteen years ago, he had a good experience with a tank, 80 feet diameter, which leaked very considerably. This was at Hebden Bridge. The tank was built of stone; and just previous to the time he went there, from £280 to £300 had been spent in trying to make the tank tight. It was the first job of the kind he had had to deal with. He took gaugings for a month, and then began to take steps to remedy the defect. He had some difficulty at first. Then he got a load of horse manure, a sack of pollard, and a bag of cement; and every day he put in about ½ cwt. of the mixture on the surface of the water round the tank. Before the end of a month, the tank proved to be perfectly water-tight; and it had, he believed, continued so until about two years ago. His method of stopping the leak cost about £5; whereas £280 or more had been spent previously, without result.

Mr. Dougall said there was only one question to reply to; and that was put by Mr. Shadbolt. The answer was that there had since been no trouble with the tank; and it was now perfectly water-tight.

A paper by Mr. R. Dawbarn, of Wisbech, on the subject of "Artificial Lighting from the Earliest Times up to and including the Introduction and Use of Gas," was taken as read. As its title indicates, it was composed largely of ancient history; and the writer had evidently laid several authorities under tribute for the material it contained. Considerable industry had no doubt been bestowed upon the research; but we are sorry that it was not in a direction which would have been, by its publication, profitable to our readers.

Official Elections.

The President said the next business was the election of officers for the coming year. He had much pleasure in proposing that their Vice-President (Mr. J. S. Dougall) be elected to occupy

the chair. As was well known, Mr. Dougall came of a good stock of gas managers. They all hoped that he would distinguish himself in the chair, and believed that he would carry out the duties in a business-like way.

Mr. F. PATERNOSTER (Felixstowe) seconded the motion, which was unanimously carried.

Mr. DOUGALL most heartily thanked the members for their confidence in placing him in such a responsible position. It would be his endeavour to preserve the best interests of the Association during the time that he held office.

Mr. T. GLOVER (Norwich) had great pleasure in proposing that Mr. Shadbolt be asked to become the Vice-President during the ensuing year.

Mr. C. F. RUGGLES (Leighton Buzzard) seconded the proposition; and it was unanimously carried.

Mr. SHADBOLT thanked the members for electing him to the position, assuring them that his services such as they were would be entirely at their disposal.

The PRESIDENT said the next appointment was that of Hon. Secretary and Treasurer; and he had much pleasure in proposing that they again elect Mr. Guyatt. No one knew better than did he (the President) the amount of work Mr. Guyatt had to do in hunting for papers, organizing the meetings, looking after the general details, and ensuring that the programme was efficiently and properly carried out.

Mr. H. WIMHURST said he should like to second the motion, as (with the President) he, from personal experience, knew something of the duties that devolved upon the Hon. Secretary and Treasurer.

Mr. GUYATT thanked the members for their confidence, and said he would carry out the duties to the best of his ability.

On the motion of Mr. J. T. JOLLIFFE, seconded by Mr. J. DAVIS, the Auditors (Messrs. C. Panchen and J. Witten) were unanimously re-elected.

Proposed by the PRESIDENT, and seconded by Mr. ARTHUR GRAHAM, Mr. J. Barton (Peterborough), and Mr. E. J. Brockway (Cleethorpes) were elected to serve on the Committee, in place of those retiring by rotation.

PLACE OF NEXT MEETING.

Mr. DOUGALL (the President-Elect) moved that the next meeting be held at Boston. It would give them great pleasure to see the Association there; and they would give the members a right royal welcome.

Mr. WIMHURST seconded the motion, which was carried.

VOTES OF THANKS.

Mr. CHILD said it was his pleasure to congratulate the President most sincerely on the meetings that had been held under his presidency. That at Newmarket was one of the most enjoyable and instructive that he (Mr. Child) had ever known during the time the Association had been in existence. The success of the year had been largely due to the untiring energy that the President had given to the affairs of the Association. The intimate way in which he had become acquainted with the wants of the Association during the long time he held the position of Secretary had enabled him to know exactly what was required; and he had filled all the requirements in the best possible way. He and the Committee deserved the heartiest thanks of the members for their work during the year.

Mr. JOLLIFFE seconded the motion, which was cordially endorsed by the members.

The PRESIDENT, in responding, said he thanked the members extremely for the kind vote of thanks they had passed to him on what was practically the completion of his year of office. His duties had been a very great pleasure to him. The longer he had been in the chair, the better he had liked it. He had been thoroughly well supported by the Committee, the Vice-President, and, especially, by what had been, he believed, the record attendances at the meetings. They had also he thought had fairly good papers—at any rate, the prestige of the Association had not suffered. He took the chair with a certain amount of diffidence; but all was well that ended well. He had now only to thank the members, and particularly their Hon. Secretary (who had been most assiduous in his duties), for their kind support on all occasions during the year.

The contributors of papers—Messrs. Glover, Dougall, and Dawbarn—were also heartily thanked, on the motion of Mr. SHADBOLT, seconded by Mr. C. G. GRIMWOOD (Sudbury).

This concluded the business.

AUTOMATICALLY LIGHTING AND EXTINGUISHING STREET-LAMPS.

There was an exhibit of the Automatic Light Controlling Company, Limited, in the room; and, after the meeting, several of the members inspected the apparatus. It was learned that the system has been applied to many thousands of lamps throughout the country, and that certain improvements have been made in it since the paper describing it was read at the Southampton meeting of the Gas Institute.

THE DINNER.

The interval between the meeting and the dinner was filled by a visit to "The Park," by electric tram. About 6.30, the members, with several friends—the Chairman and Directors of the Gas Company being the guests of the Association—dined together. Subsequently the customary list of toasts was gone through. That of the Association was given by the Chairman of the Gas Company (Mr. Harris); and in his acknowledgment it was mentioned by the President that the organization was now sixteen years old. He also referred to the affiliation resolution of that day as being a step in the right direction. "The Peterborough Gas Company" was proposed by Mr. Child. He alluded to the manner in which the Company had maintained the growing requirements of the town in respect of the gas supply, and to their having been served by engineers of standing, the last of whom was their friend, Mr. Barton. For twenty years at least, he had had control of the works. The Directors had used their judgment wisely in selecting an Engineer to command their undertaking, and in giving him ample scope to exercise the ability he had in him. Enlarging upon this point, he spoke of the enormous addition to the duties of a gas manager that the incandescent mantle had imposed, and then touched upon the question of maintenance. In this connection, he said that he recently heard of a case where a gas engineer was proposing to adopt a very drastic method. Instead of making a reduction in the price of gas, he had proposed that his Company should take charge free of the whole of the incandescent burners in the town. Of course, such a step would be conferring a benefit at the present time on only one part of the consumers; but there was no doubt that ultimately all would benefit. In his reply to the toast, Mr. Harris stated that the installation of the electric light in Peterborough had not checked the Gas Company's increase. The first year that the electric light came, the Company prospered as much as ever; and they had done so ever since. Before their competitor came four years ago, they had a monthly average of 15 or 20 new applications for gas; while last month alone, they had applications for 100 meters and over 99 stoves. There were several other toasts; and speeches, song, and recitation combined to give much pleasure to those present.

Discovery of Thorite in Ceylon.—In connection with the mineral survey now proceeding in Ceylon, in conjunction with the Scientific and Technical Department of the Imperial Institute, specimens of minerals supposed to be monazite and uraninite have been sent recently to the Institute for investigation. The first of these has proved, on analysis, not to be monazite, but thorite, which is a silicate of thorium, containing over 66 per cent. of thorium oxide. The supposed uraninite has proved to be a new mineral, which it is proposed to name thorianite. It contains 75 per cent. of thorium oxide (thoria), in addition to small quantities of the oxides of cerium, uranium, and lead. Thorianite is therefore richer in thorium than any mineral at present known.

Gas-Meter Testing in France.—It appears from some figures published in a recent number of the "Revue Industrielle," that the number of meters which passed through the Testing Department in Paris doubled in the ten years ending in 1900. In 1891, the number was 39,597, corresponding to 333,767, burners; while in 1900 it was 78,447, corresponding to 547,760 burners. In the next two years, the figures were 67,618 and 68,293 respectively. The fees received in 1891 amounted to 30,039 frs. (£1202); in 1900 to 49,298 frs. (£1972); in 1901 to 42,137 frs. (£1685); and in 1902 to 42,461 frs. (£1698). There has consequently been a falling off in the testings in the past two years. The number of burners averages 7·2 per meter; and as the fees are charged at 9 c. per burner, the testing and stamping of a meter costs rather less than 65 c.

Self-Instruction for Students in Gas Manufacture.—We have received from Messrs. John Allan and Co. two useful handbooks suitable for students preparing for the City and Guilds of London examinations in "Gas Manufacture." In one, which has reached a second edition, answers are given to questions based on the Ordinary Grade syllabus; in the other, which now appears for the first time, those in the Honours Grade are dealt with. The matter was originally written for a series of articles in the "Gas World;" but in its present form it is, of course, much more convenient for reference. The publishers have placed within reach of students a ready means of acquiring much information in regard to the manufacture of gas; and if the latter will only use it in the right way, they will not have much reason to dread the ordeal of the examination in either grade.

The Gas Congress at St. Louis.—The Committee appointed by the American Gaslight Association to arrange for a congress of the American Gas Associations in connection with the St. Louis Exhibition, recently held a meeting, at which it was decided that the members should assemble in a hall in the grounds of the exhibition on Wednesday and Thursday, the 15th and 16th of June, from ten till two o'clock, for the consideration of the various matters to be brought forward; and that the government of the congress should be vested in the Presidents of the participating Associations. The President of the American Gaslight Association is to preside over the governing body and also at the opening sitting. The following have been appointed Chairmen of Sub-Committees: Mr. E. J. Cowdery, of St. Louis (Arrangements); Mr. W. M'Donald, of Albany (Finance); and Mr. Walton Clark, of Philadelphia (Papers). The Committee have decided to print the proceedings, if a sufficient number of subscriptions for the volume can be secured in advance. We learn from the "American Gaslight Journal" that several Associations have officially accepted the invitation to take part in the congress, have appointed Committees to work with the one originally formed, and have contributed to the fund now being raised to defray expenses.

A JUNIOR GAS ASSOCIATION FOR SCOTLAND.

A Meeting, called by Mr. H. O'Connor, for the purpose of promoting the formation of a Junior Gas Association in Scotland, was held in the Heriot-Watt College, Edinburgh, last Friday evening. Mr. A. WILSON, Gas Engineer to the Corporation of Glasgow, presided. Mr. O'Connor intimated that he had expected that Mr. W. R. Herring, the Gas Engineer of the Edinburgh Corporation, would take the chair, but that he had received a telegram from him, dispatched from Folkestone Pier that afternoon, expressing his regret at his inability to be present, but promising to give the movement every assistance in his power.

The CHAIRMAN said he had received an honour he certainly had not expected. He did not suppose he would have to take an active part in the proceedings, but he might say that, now he was placed in the position, he was very glad to do so. Ever since the subject of a Junior Association was mooted, he had taken an active interest in it. He got Mr. Lowe, one of his assistants, to go into the matter, so far as the West country was concerned; and he thought that, up till then, they might safely count upon having from 100 to 150 names from the Glasgow district. He expected that this was only the beginning of the movement. They had a very wide district in Glasgow, and they intended to have a meeting shortly to see what was to be done in regard to the Association. One question they had to consider was whether they were to form one Association, or a number of branches, and perhaps have a general meeting once a year. Seeing that most of the members would be young men, he thought the meetings would have to be held pretty often throughout the winter session; and, as all would not be able to afford to take long journeys, perhaps it would be better to form Branch Associations in the first instance, and after they were formed, the Presidents and Secretaries of the Branch Associations might meet together and make arrangements for the holding of an annual meeting. Of course, the whole thing was open for discussion; and if it was thought advisable to have one large Association, he had no doubt that they in Glasgow would be ready to meet with such a proposal. In regard to the part he was taking, he was only intending, so far as possible, to get the Association on the rails. After it was there, he thought there would be quite enough steam among the the young people to keep the thing going without any assistance. At the same time, he thought the juniors might rely upon it that the seniors would give them every assistance in their power, while allowing them to manage their own affairs, which would be an education in itself.

Mr. W. M'CRAE (Falkirk) said Mr. Wilson had voiced his ideas very well. The proposal had his hearty support. They knew that in the winter time it was very difficult for the chief engineers of gas-works to get away; and this also applied to the juniors. He thought, therefore, that it would work very well indeed to have, in the first instance, one large Association for the whole of Scotland, and let it be divided into districts, with a Secretary for each. The District Associations could meet once a month, or as might be arranged, and then, in the summer time, when things were going easy at the works, there might be one large meeting, at which papers could be read, and a general discussion held upon what had taken place at the branch meetings during the winter. He was sure that all of them would look upon it as a matter of very great pleasure to give the Junior Association all the support they could.

Mr. O'CONNOR read letters from the Secretary of the Manchester District Junior Gas Association and the Presidents of the Yorkshire and London Junior Gas Associations, offering assistance, and wishing the Scottish Association success. Copies of the rules of these Associations had, he said, been forwarded to him, and there was one item he would like to see slightly different in any Association they might form in Scotland. He referred to the rule as to the qualification for membership. In the other Associations the membership was confined to "persons engaged in the manufacture or distribution of illuminating gas or in the working-up of products obtained therefrom." This seemed to him to debar attendance at meetings of a number of young men who should be members of the Association. He had in his mind young engineers, who had served in their own works, and who were now admirable gas managers in various parts of the country. He entirely agreed with the ideas of both Mr. Wilson and Mr. M'Crae, as to there being one general Association for Scotland, and branch meetings in various places, in order to suit the members. He had another suggestion to make, and that was that, perhaps with the assistance of the engineers, the meetings might be held in the afternoon, so as to enable the members to get home the same night. A number of the Associations had either honorary patrons or honorary members. He thought this was an admirable arrangement. Honorary members would, no doubt, be those who were high up in their profession, and who would take an interest in the Association, and help it forward. In some cases, the expenses of managers, when they attended the gatherings of Gas Associations, were paid by their employers; and surely some small amount might be given to the young men to enable them to attend the meetings of the Association. Everyone was agreed that such meetings were necessary for the welfare of the country; and he was sure that the technical education obtained at meetings such as theirs would be was of great value. They might have a question-box, because they knew the difficulty there was in getting papers. Upon this subject let him remark that the papers need not be literary articles, but couched in plain, practical, common-sense language. Let them have facts, if they had not grammar; let them have real points in the papers, though the spelling might be bad.

Mr. D. WALKER (Dunfermline) supported the proposal to have a general Association, with branches. He did not see how one could be conducted with advantage or any other lines. He thought that while they were there they should appoint a Secretary for the Edinburgh district.

Mr. J. LOWE (Glasgow) was quite at one with the views which had been expressed. He thought they should give each of the branches as much liberty as possible—allow them to choose their own hours of meeting and their own session, and to appoint their own office-bearers. They should frame their rules so that each branch might have as much scope as possible, to do as they wished. He did not think it would be possible to arrange district meetings during the day; but the general meeting might be held then. He supposed the object of the rule to which Mr. O'Connor had referred was to prevent Associations being exploited by manufacturers—making them to be regarded more from a commercial than from an engineering standpoint. He thought, with Mr. O'Connor, it would be a great pity to prevent a class of men from attending their meetings simply because they were not actively engaged in gas-works; but, at the same time, they wished, if possible, to prevent the Association from being used for purposes of advertising. He did not feel at all hopeful that employers would pay the fares of members. He thought they ought to try to go upon their own resources as much as possible, and not be beholden to anyone. He considered the question-box was an excellent idea, and would probably be used to great advantage in the work of the Association. He agreed with the proposal to appoint that night a Secretary or an interim Secretary who would get in names, and then convene a meeting at which rules could be framed.

Mr. J. DICKSON (Broughty Ferry) thought the Association should be free to all workers in the gas industry, whether in regard to plant before it came into the works, or to (say) tar distillers and analysts in works. The Association should be free to as many as they could get useful information from.

The CHAIRMAN remarked that they could not do anything in the way of forming a Junior Association that night. This would be more the work of a general meeting. The general idea of a Junior Association was that it must be composed of young men. This was not his idea. The Association would be composed of men who were not in leading positions, or who did not care to attend the meetings of the Senior Associations. To his mind, they might have men from meter-shops, and from every branch of the gas industry. The question of admitting those who were engaged in the manufacture of gas appliances would be a matter for consideration; but, in his opinion, it would be a pity to exclude them. He thought they could quite easily guard against the Association being used for purposes of advertisement. He suggested that they should have a representative meeting, at which they could discuss the formation of an Association and the making of rules. If those who were present from the Edinburgh district would appoint a Secretary that night, this would begin the matter.

Mr. O'CONNOR suggested that there should be a lending library in connection with the Association, and he thought it should be a general library, and not connected with the Branch Associations. The rule as to qualification might be made to include all engaged in the manufacture and distribution of gas, the working-up of products obtained therefrom, and the actual making of apparatus for the manufacture or distribution of gas. He spoke guardedly, and with fear and trembling; but he thought the Committee of the North British Association of Gas Managers refused to join with the Institution of Gas Engineers owing particularly to this difficulty—that it would mean that a number of their members would have to resign. He proposed that they should ask Mr. H. Rule, the Assistant-Manager of the Falkirk Corporation Gas-Works, to undertake the duties of Secretary in the Edinburgh district.

This was agreed to unanimously.

The CHAIRMAN said this was really the first piece of business which had been done for the Junior Gas Association for Scotland. He congratulated Mr. Rule on his having been appointed as the first officer of the Association, and he hoped he would not be long without plenty of comrades in the good cause.

Mr. O'CONNOR expressed the opinion that there would be no difficulty in obtaining the use of a room in the Heriot College for their meetings. Principal Laurie was most anxious to do everything in his power to assist technical education. They had to thank him for the use of the room that night.

Mr. LOWE wished to make a remark as to the meaning of the word "Junior." As he understood it, it meant that the Association was formed at a later date than the other Associations. He was sure they would welcome all, whether they belonged to other Associations or not. He considered that in Scotland there was room for a separate Association, and that they might be able to do quite as good work as the others.

Mr. O'CONNOR proposed votes of thanks to Mr. Wilson for presiding, and to Mr. M'Crae and other speakers.

Mr. M'CRAE proposed a vote of thanks to Mr. O'Connor for the trouble he had taken in organizing the meeting. Regarding the word "Junior," he thought that the gentlemen who would form

the membership of the Association would be in similar positions to those who were associate members of the North British Association. There would be this difference—that associate members were not eligible either to vote or to hold office in the North British Association; but they would be eligible for both in the Junior Association.

The CHAIRMAN said he was convinced that they had that night put the Association on the true lines on which it should go; and that they would all, seniors as well as juniors, benefit by the Association. When he was a young man, such an Association would have been hailed by him with delight, as they had all to grope their way for themselves.

The meeting then closed.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Professor Rhead on Refractory Material.

At a Meeting of the above-named Association held on Saturday at Ingham's Hotel, Manchester—the PRESIDENT (Mr. W. Hill) occupying the chair—an interesting address on "Refractory Material" was delivered by Mr. E. L. RHEAD, Lecturer on Metallurgy, &c., at the Manchester School of Technology.

The PRESIDENT said he had no need to introduce Mr. Rhead, as he was already well known to most of the members; and he was sure the address he had promised them would rank as one of the best papers that had been brought before the Association, because the subject was one which was of exceptional interest to all gas engineers. It was of great importance that they should be fully acquainted with the properties of refractory material used in gas-retorts. It was an old saying that the money of a gas-works was made in the retort-house; and if they did not have the right material there, they all knew the result was a loss to the concern.

Mr. RHEAD said, in the first place, he had to apologize that he had not written out his paper as he had intended. This had unfortunately been impossible; and as a consequence his remarks might perhaps not be quite so connected as they otherwise would have been. Dealing first with the general principles determining refractoriness, he said the consideration of refractory materials was one of those subjects to which, as their President had observed, the attention of those engaged in gas manufacture must of necessity be turned; but it was one probably to which less attention was given than to any other in connection with this important industry. Since all gas-works depended largely upon the quality of the material that was employed in the construction of the retorts and settings, there was probably no question that affected more closely their welfare, from the manufacturing point of view. The question presented itself in two main aspects—first, the capability of resisting heat; and, next, the non-liability to fusion or distortion, which might be said to define generally the character of refractoriness. The refractoriness was dependent mainly upon chemical composition. The substances used for refractory material were not usually simple ones but combinations and mixtures of various materials which, though they might be refractory themselves, had certain chemical affinities that made them become fusible. There was, however, a considerable variation in the temperature at which substances when combined with silica would become fusible. One important consideration to be borne in mind was the selection of a substance that possessed the right texture. Closeness of texture was largely due to the degree of hydration and the fineness of the particles; and it was due largely to the coarseness of these and the peculiar plastic character that the clay possessed, that some of the fire-clay had attained so high a reputation. The materials which gave the best results were those which had a coarse grain; closeness of texture being associated with a tendency to crack under a sudden heat after cooling. Another consideration was the tendency to fluxing by the partial fusing of the internal material; thus causing the material to contract. This was brought about by the expulsion of the water of hydration more than by the fluxing material. This was why brickwork, which, though very well set, and looking exceedingly well set up, was ultimately rendered unsafe by continuous heat, which caused contraction. It therefore became necessary to determine whether the first contraction was the only one that was taking place. Generally speaking, those substances which contained the smallest percentages of impurities were the most reliable. All clays that contained any large quantity of particles of soda—anything above 1 per cent.—were liable to produce trouble from contraction of the material. One thing that was often overlooked in fire-clays was the presence of iron pyrites—one of their rather common constituents. These gave trouble, as, when ground up and exposed to heat and the action of the air, they became converted into fluid oxide, which became fusible in the silicate. There was another difficulty. If it happened that the fire-clay contained organic matter, the trouble was increased. The effect of these metal oxides on refractory materials was, however, often overlooked.

By means of an elaborate analysis of clay and refractory materials, copies of which were placed in the hands of the members, the lecturer dealt in detail with the general principles determining refractoriness; natural refractory materials; the fluxing properties of various bodies; the influence of chemical composition and physical structure of fire-clay and bricks; and the cracking and failure of retorts and settings. He then gave some valuable data with regard to the setting of fire-clay bricks, the properties of good cement for stoppings, and the methods of testing.

Mr. Rhead next proceeded to explain the reason why a fire-clay joint to a fire-clay brick frequently contracted. He stated that this was because, when the ordinary fire-clay brick was made, the gradually tempered clay was put into a mould, dried, and then burnt. The drying had been slow, and a solid compact mass was produced which was subsequently burnt. They took the fire-clay joint. It was more or less plastic, and in a large majority of cases the clay had not been properly tempered; and the result was that they got a material which when heated was liable to become soft and powdery. If they were going to have their joints good, they must have as little material as possible, and have the joints as close as practicable. Even where they had taken the greatest care to have a good fire-clay, which was properly put into position, the hammering of the bricks well home could not be too much insisted upon. With regard to the use of silica, its tendency to expand when heated stood it in very good stead in many cases, as it largely compensated for the contraction that was taking place from other causes; and, as a result, the stability of the material was guaranteed for a considerable period. This, of course, could not go on for ever, as there was a gradual tendency in the silica to cause looseness in the setting. When they required something to be stable for a protracted period, they wanted the whole arrangement to be as immovable as possible, or to move uniformly, otherwise it brought about disintegration of the structure; so that if they had a retort that expanded more than the brickwork, it would sooner or later force this out. With regard to failures, these were often due to overheating and to the use of unsuitable materials that had not been sufficiently burnt. In addition to fire-clays, there were some other materials employed for various purposes which were worth some brief notice. For example, that known as ganister, which was really a sort of clayey sandstone containing about 89 per cent. of silica, some 2 or 3 per cent. of alumina, and small quantities of oxide of iron and lime. The alumina was present as clay, and possessed the peculiar property that there was sufficient clay to enable the material to stick together, but not enough to cause it to break away. This property rendered it peculiarly suitable for patching, because its contraction was not sufficient to make it detach itself from other substances. Difficulties were often found with cements for stoppings. With regard to these, one consideration should always be borne in mind—that, whatever the substance employed, it must, in the first place, possess body enough to retain its shape, and must contain sufficient fluxing material to cement together the body of the cement itself, and cause it to adhere to the retort to which it was applied. Generally there was much room for improvement in these cements; the great *desideratum* being to have a skeleton that would preserve its form and shape, and at the same time have the same coefficient of expansion as the retort, and sufficient fluxing material to cause it to stick together and to the retort. Failures of retorts were often due to heating too suddenly; overheating, cooling, and reheating; cold air striking the retort; failure of support; and, finally, wet coal being put into the retorts, which, of course, should never be done.

The PRESIDENT said Mr. Rhead had given the members a very lucid explanation of the important matter with which he had dealt in his address; but if there were any points on which further information was required, he was sure the lecturer would be glad to furnish it.

Mr. GARLICK remarked that Mr. Rhead had not left them much scope for discussion, as he had gone so fully into the whole subject.

Mr. TAYLOR said there was one point with regard to vitrification that took place on fire-bricks upon which he would like information. It was whether it caused the whole of the brick to crack.

Mr. RHEAD replied that if it was simply running down the surface, it might drag away a portion of the brick; but it did not necessarily cause the brick to crack right through. It was internal vitrification that did this.

Mr. TAYLOR said he had come across a practice of working the fire-bricks with a salt solution; and he asked whether this was a good one.

Mr. RHEAD said this had the effect of glazing the surface. It was an advantage in setting a regenerative furnace, but not in setting any other type.

The PRESIDENT, in moving a vote of thanks to Mr. Rhead for his lecture, said, from his experience of refractory material, the trouble had arisen through insufficient burning. They had great difficulty in getting the fire-brick manufacturers to burn their material properly.

Mr. HALLIWELL, in seconding the motion, remarked that the subject was one that should be more frequently brought before Associations like theirs. It was a matter of special importance to all gas engineers; and it was surprising that it did not receive greater prominence.

Mr. RHEAD briefly responded, and said that if he could at any time afford the members further information that might be desired on the subject, he should be most pleased to give it.

INTERNAL-COMBUSTION MOTORS.

The "James Forrest" Lecture.

At the Institution of Civil Engineers on Thursday, the Twelfth "James Forrest" Lecture was delivered by Mr. DUGALD CLERK, M.Inst.C.E., who selected the above subject for his discourse. It was most exhaustively dealt with; but only certain portions are of special interest to our readers. These we reproduce.

In his introductory remarks, Mr. Clerk pointed out that during the past 25 years, engineers have applied internal-combustion motors to all manner of uses, in powers ranging from the tiny ½-horse motor to the huge 2000-horse power engine. They have adapted the motors to the consumption of many different kinds of inflammable gases and vapours, and they have continually increased both mechanical and thermal efficiency until, at the present time, these motors compete with steam in almost every field. For small and moderate powers, their advantages greatly outweigh those of steam; and, accordingly, they have displaced steam and revolutionized the application of power in towns for the industries requiring only moderate forces. At first these motors were practically limited to the use of town gas; and, although the heat efficiency was much superior to that of steam, yet the gas fuel was more expensive per heat-unit than the cheaper coals which could be used under steam-boilers. This led to the application of producer gas by Mr. Dowson, which extended the gas-engine field by reducing the cost per heat-unit to less than half that of coal gas. Later, the heavy hydrocarbons were pressed into service in the form of paraffin and petroleum oils; and this widened the field to include agricultural motors and motors required in positions where no ordinary coal gas or producer gas was available. The demonstration by Mr. B. H. Thwaite, in 1895—that the so-called waste gases from blast-furnaces could be used in gas-engines—has led to the introduction of the very large motors now becoming common both on the Continent and in England. Other gases are utilized for these motors—in America, natural gas and wood gas; and in Britain and the Continent, water gas and coke-oven gas. In making these numerous applications, the engineer has met all manner of difficulties—mechanical, physical, and chemical; and, with the assistance of such scientific knowledge as existed, he has overcome many, and skilfully evaded others. Much has been done, but more still remains to be done, before finality can be said to be even approximately attained. In the lecture, it was his privilege to deal with the latter rather than the former.

Mr. Clerk proceeded to show that development has followed two main lines—first, improvements relating to the motor itself, including changes in the thermo-dynamic cycle, followed, in the treatment of the working fluid and the inflammable gas within the motor, by the modification of such details as admission-valves, igniting devices, governing devices, and water and air cooling devices; and, secondly, those relating to means of generating the inflammable, gaseous, or vapour fuel intended to operate the motor. These improvements have related to the economical production of ordinary coal gas, to the effective production of producer gas from anthracite, bituminous non-caking coal, coke, and other solid fuels, to the treatment of heavy and light hydrocarbons and alcohol to produce an effective inflammable vapour, and to the purification and collection of blast-furnace, coke-oven, and natural gas. With regard to mechanical improvements, Mr. Clerk said four well-marked divisions might be considered: (1) Motors for town gas; (2) motors for heavy oil; (3) motors for light oil and alcohol; and (4) motors for producer and blast-furnace gas. To illustrate these four divisions, he exhibited a number of diagrams which showed the extreme diversity of construction utilized in these engines.

Having disposed of mechanical details, Mr. Clerk passed on to the subject of efficiency, as here, he said, would be found the main ground where the physicist and chemist could assist the engineer. In this connection he gave a table of heat balance-sheets from 1882 to 1900, presenting the results obtained by many well-known engineers from different engines tested between these dates. It showed a steadily-increasing efficiency. In Slaby's first test, the heat converted into indicated work was only 16 per cent. of the total heat given to the engine, and this has risen to 28 per cent. in 1898 and 1900, as shown by tests of Crossley and "National" engines. Higher efficiencies than these are claimed, and it may now be accepted that heat efficiencies of 30 per cent. and slightly over have been really attained by these engines. The table showed another peculiarity in the numbers indicating the heat rejected in the water circulation. This proportion has been steadily diminishing, and it reaches a minimum in the large Crossley engine tested by Mr. Humphrey, where the heat loss to the water-jacket is only 24·2 per cent. of the whole heat supplied. In 1882 and and 1884, the tests of Slaby and Thurston show the heat rejected in water circulation as 51 and 52 per cent. The Society of Arts trials show a reduction in one case in the Crossley engine to 43 per cent. and in the Griffin engine to 39 per cent. when the unaccounted-for heat is included. In Humphrey's test of the Crossley engine of 1900, the heat loss to the water circulation was 24·2 per cent. In Robinson's test of the "National" engine in 1898, the heat loss was 33 per cent. In only one of the recent engines—the large Cockerill engine, tested by Professor Witz in 1900—does the heat loss remain as high as in 1882. It is evident from these figures that although engineers have succeeded in increasing the amount of heat converted into work and diminishing the heat flow through the sides of the cylinder, they have increased the discharge of heat with the exhaust gases.

To explain the reason for this, Mr. Clerk proceeded to consider the thermo-dynamics of the subject, so far as it is at present understood, in order to see whether any further knowledge is required to enable the meaning of the relative losses and gains in these engines to be better appreciated. He remarked that, although the general thermo-dynamics of the internal-combustion motor might be considered to be broadly understood, yet physical and chemical knowledge of the properties of air and other gases at high temperatures was as yet insufficient to enable the physicist or the engineer to formulate a quantitatively accurate standard engine of comparison; in other words, to formulate a conceivable engine in which all heat losses by conduction and radiation are suppressed, and where the efficiency is the full efficiency of the particular cycle under the assumed conditions, whether perfect or imperfect. To this branch of the subject, a large portion of the lecture was devoted. Mr. Clerk showed, with much elaboration, the principles upon which the past 25 years' advance has been made, and indicated what knowledge is required to formulate an accurate standard of comparison, and what advance should be followed to reduce temperatures and increase mean pressures.

In the course of his remarks on this subject, Mr. Clerk said: The question of high mean pressures is a most important one. In many of the large gas-engines the mean working pressures are relatively low; in the large Continental engines, mostly 60 lbs. per square inch or under. British-built engines usually operate the medium sizes at pressures as high as 90 lbs. and 100 lbs. per square inch; and the English engineer at present is by no means satisfied with the average pressures which he can safely employ in existing large gas-engines. To obtain high mean pressures is to have an engine of great power for small dimensions; but it flame temperatures be reduced to prevent heat-flow difficulties, and save heat in this way, the mean pressure is also reduced. It is very desirable to reduce heat-flow, especially in large gas-engines. Some time ago, it appeared to me possible to reduce maximum temperatures while increasing mean pressures by increasing the charge weight per stroke given to an engine. I had experimented with two engines, one of 7-inch cylinder and 15-inch stroke, and another of 10-inch cylinder and 18-inch stroke. These engines, which are of the ordinary standard four-cycle type, are allowed to take in the usual charge of gas and air; then, at the end of the stroke, a further charge of air or other inert fluid is added to increase the pressure in the cylinder to 7 or 8 lbs. per square inch above atmosphere before the return of the piston begins. This has the effect of increasing the charge weight present in the cylinder by about 40 per cent., and of raising the pressure of compression, without, however, increasing the temperature of compression. Indeed, in both experiments, the temperature of compression was diminished. As the charge present is constant so far as gas is concerned, the maximum temperature capable of being produced is much reduced. The maximum temperature in the diagrams taken by me from these two engines is about 1200° C. Experiments were made, and it was found that the heat-flow was reduced to about two-thirds; and, further, that the mean available pressure was increased about 20 per cent. This method supplies another means of increasing the economy of these engines without changing the thermo-dynamic efficiency, simply by reducing heat losses—that is, in these cases, the economy is effected with a heat cycle of unchanged thermo-dynamic efficiency by effecting a change in the heat-flow through the cylinder walls. This method of increasing practical efficiency has the merit of reducing temperatures all round, and preventing pre-ignitions in two directions—namely, by temperature reduction, and also by reducing the average inflammability of the charge, so that it is less readily ignited on compression.

Before leaving the subject of thermo-dynamics, Mr. Clerk suggested to the physicists that profitable study might be devoted to the question of the laws governing the efficiency of imperfect cycles. He pointed out that the text-books devote a great deal of attention to perfect cycles of operation, such as the Carnot cycle or the perfect regenerator cycle, but little attention is given to the theory of imperfect cycles, which, after all, are the only ones that can possibly be carried out into practice. Again, the laws of the cooling of gases under various pressures at high temperatures do not seem to be known with any accuracy. To some extent valuable data might, he thought, be obtained by measuring the maximum pressures and temperatures of gaseous explosions, both with and without initial compression, in large and in small vessels, for simple and complex mixtures of varying dilutions. The cooling curves, too, were required in closed vessels for all these mixtures. Similar measurements of such explosions should be made for light and heavy hydrocarbons, for alcohol, blast-furnace gas, producer gas, coke-oven gas, and all the numerous inflammable gases and vapours now pressed into the service of the internal combustion motor. More determinations of this kind are urgently wanted, as the older experiments are now out of date, with the change in the composition of town gas and the extended use of the other gases.

With regard to the second line of development—viz., improvements relating to the means of generating the inflammable gaseous or vapour fuel intended to operate the motor—Mr. Clerk thought

it was necessary to say only a few words. The Dowson producer had, he said, been greatly improved upon; and recently a modification known as the "suction producer" had been introduced both in England and on the Continent. Monsieur Benier was the first to experiment with some success upon this producer; but now it was rapidly coming into use. Its great advantage was the absence of a steam-boiler for blowing, which characterized the older Dowson type, and the abolition of a gasholder. The air and water vapour required for the production of gas was drawn through the incandescent fuel by the operation of the engine itself. So far, the Dowson suction producers had been operated with anthracite and coke; but modifications were in preparation for working with bituminous non-caking coals of a cheaper class. The suction producer offered fascinating possibilities in aiding the application of the combustion motor to marine purposes. It only required engines now to be built which were able to reverse, to apply the gas-driven internal combustion motor to marine purposes for very considerable powers indeed. Mr. Clerk expressed his pleasure at observing that an authority so eminent as the distinguished President of the Institution, Sir William White, had expressed himself in favourable terms on the possibilities of this application of the gas-engine.

On the subject of gas-producers, the lecturer said: Much yet remains to be done in adapting gas-producers to use the cheaper kinds of fuel of a bituminous nature. Dr. Mond has built producers for this purpose, and he is to be congratulated on his daring in attacking a difficult problem on a large scale. The results to be obtained from his large central gas-supply station in South Staffordshire will be watched with the utmost interest by all concerned in the combustion motor. Meantime, the use of his gas installations for works of varying nature affords valuable experience in the production of gas for engines from bituminous fuel. But Dr. Mond's producers can hardly be considered as approximating to the final solution of the difficulties of gas production from bituminous fuels. It will be necessary to design producers which do not depend upon the recovery of ammonia for profitable work. The manufacturer using moderate power units must be catered for by the engineer; and he certainly will require producers using fuel no dearer than he burns under his steam-boilers, and in bulk as small at least as the boiler. Messrs. Crossley have given considerable attention to the producer problem; and I am informed by them that they have obtained success in the use of bituminous fuel. This bituminous fuel problem is a most interesting one for the consideration of both the chemist and the engineer. The difficulty, of course, is to design a producer which shall give a high heat efficiency and avoid caking and produce the minimum of tar.

In connection with the subject of inflammable material for use in the motor, Mr. Clerk made the following remarks on the subject of gas as the fuel for motors: Coal gas was the first to be used for motors; and it is still the fuel most considerably employed. It seems possible now, in view of the incandescent gas-lamp, to dispense almost entirely with the intrinsic illuminating power in coal gas; and if parliamentary sanction can be obtained to this step, a very cheap gas could be sold with a very high thermal value. A gas with a thermal value of 500 B.T.U. per cubic foot, sold at 1s. per 1000 cubic feet, would enormously benefit the industries in the towns by providing them with cheaper motive power and cheaper means of heating. No doubt the problem presented can be solved by our chemists, it being to produce a gas combining in its properties the flame temperature needed for the incandescent mantle and the heating value and low inflammability required for the successful operation of internal-combustion motors. One great development—perhaps the greatest of recent developments in connection with these motors—is the application of blast-furnace gas. This gas, so plentifully produced by our blast-furnaces, appears capable of supplying cheaply and continuously nearly 750,000-horse power in Britain alone.

In the course of his concluding remarks, Mr. Clerk said: The internal-combustion motor offers, perhaps, the best instance of international industry which could be imagined. England stands at the head of all nations in the production of the smaller and medium-sized fixed gas-engines. She has produced altogether something approaching 100,000 engines of an average of 20-horse power. This is greatly in excess of the whole Continental output of engines of this type taken together. On the other hand, Continental engineers have given more attention to the large gas-engine—engines of 500-horse power and above—and the application of blast-furnace gas to the use of the large engine. In this field of internal-combustion motor work, Germany excels. In America, engineers are now giving considerable attention to the internal-combustion motor; but, so far, for some reason, the Americans have not shown in this subject the inventive and progressive spirit which they usually display. It may be said, however, without exaggeration, that the whole world is now alive to the possibilities of these motors, and that progress will be more and more rapid. They have almost fulfilled the expectations of those engineers who, like myself, have devoted a large part of their lives to their study and advancement. They are looking forward now to the completion of the work begun so many years ago; and they expect, at no distant date, to find the internal-combustion motor competing with the steam-engine, even in its latest form, the steam-turbine, on sea as vigorously as it does at present on land.

NEW ENGLAND ASSOCIATION OF GAS MANAGERS.

(*Concluded from p.* 98.)

Water-Heaters.

Mr. A. J. Campbell gave an account of some experiments conducted by himself and Mr. G. B. Leland on the efficiency of circulating water-heaters. The apparatus to be tested was fitted up in connection with a 30-gallon cylinder, and supplied with gas through a test meter at constant pressure. Tests were made by noting the rise in temperature over the whole system, or by drawing off hot water into a counterpoised bucket. The author's results were exhibited in graphic form, and showed an efficiency of 340 to 480 units per cubic foot of gas used. It was found that the best results were obtained with a moderate temperature; and that as the heat of the water rose, the loss by radiation, &c., also increased, and the efficiency was therefore lower. Apparatus made of iron was only 80 or 85 per cent. as efficient as that of brass or copper; and there appeared no question as to the superiority of the latter. Sometimes boiling water was required; but for domestic use a heater that would furnish a large quantity of water at 110° to 120° would answer best.

The President, in opening the discussion, asked for information as to how water-heaters were received by consumers, and thus diverted attention from the subject proper. The Secretary followed suit by raising the question of iron *versus* brass heaters. He always recommended brass heaters; but some people would have the cheaper kind, and therefore it was well that the defects or troubles with iron heaters should be known. He would also like to know if anyone was doing anything with automatic thermostat attachments. Mr. Neild said it was generally found that the iron heater might be used for a short time; but rust soon appeared, and it would be worn out in a year or two. It was absolutely valueless. Mr. Fowler tried an iron apparatus in his own house, but found so much trouble from rust that he changed it for a brass one. Mr. Barnes thought that the so-called "rust" was to a large extent the deposit from hard water; and that if the bottom of the heater was kept well above the bottom of the store-tank, so that the sediment could not get into it, iron heaters might be used. He had a large number of galvanized iron heaters in his district, and believed they gave satisfaction. He supplied the apparatus at cost, but did not undertake the fixing. Mr. Hintze and Mr. Apica both said that iron apparatus was practically worthless. Mr. Scranton thought something turned on the quality of the water, as he had 200 or so cast-iron heaters in use and found no trouble. To meet the objection that the gas-cooker did not furnish hot water, he had adopted the plan of fitting a heating pipe-coil in the house-furnace. It was a cheap and simple device, and in many cases secured the use of the cooker all the year round. Mr. Price said he was advised that, by galvanizing the heater inside as well as out, trouble from rust would be avoided; and the result of several years' experience went to show that this was correct. He would like to know whether a pipe-coil or a reservoir was the preferable form of heater. At this point, the President ascertained, by a show of hands, that the usual practice was to sell heaters at cost. Mr. Sargent was in the unfortunate position that he could not use iron heaters, and his customers objected to the cost of brass ones. Mr. Baldwin suggested that in most towns the water-works officials had given attention to the effect of water on various metals and could give valuable information on questions relating to the use of iron or brass heaters. The general opinion was that iron in connection with hot water was short lived.

Mr. Campbell, in reply, said he always fixed a flue to take off the products of combustion, as without it complaint was sure to arise. As the water for domestic use was required at a fairly constant temperature—say, 120°—he thought there should be a regulating device to secure this result at all seasons of the year.

Gas-Engines.

Mr. H. W. True, of Boston, read a paper on "The Gas-Engine from the Manager's Standpoint," some extracts from which were given in the "JOURNAL" for March 29 (p. 847).

Discussion being invited, Mr. Lloyd instanced a 125-horse power gas-engine that was considered to be cheaper than steam with gas at 4s. 2d. per 1000 cubic feet. He agreed that the company should test the engines, and advocated very substantial and simple construction—all parts accessible for cleaning, &c., and all bearings protected as far as possible from heat, and so arranged as to admit of efficient lubrication. Sediment would be sure to collect in the water-jacket, and means should be provided to allow of its removal. Every company should have a man who thoroughly understood gas-engines, and could deal with defects or difficulty in working. The four-cycle hit-and-miss governor, fixed charge and compression, was not improved upon as regards efficiency, and not likely to be. The two-cycle was not economical, and never an unqalified success. Mr. Witherby gave particulars of some 250-horse power engines running on natural gas, and mentioned that he had a 1400-horse power one in hand. This would help to use up the natural gas. Mr. Snow understood that the statement that electric motors cost three times as much as gas at 4s. 2d. per 1000 feet was based on a price of 3d. per unit; but it was well to remember that electricity was sold at as low as 1d. per unit for power purposes. Mr. Baldwin agreed with

the suggestion that the gas companies should take or secure some guarantee as to the brake power of the engine, as they were often bought from irresponsible people more on a basis of cash than of quality. In this way, a large amount of business was lost to gas companies. It was important that one person only should be responsible for the working of a gas-engine; and he had known trouble to arise from the officiousness of the man in charge in attempting to alter or "improve" some of the structural details. The engine department would pay for proper cultivation. Mr. J. J. Humphreys said that, before incurring any expense in pushing gas-engines, he would like to know something further as to the gas-turbine.

Mr. True admitted that the four-cycle hit-and-miss engine was the most popular at present, probably because its thermal efficiency was as good on a light as on a full load. But he believed that in a few years it would be displaced by the two-cycle. The position he took in the paper referred to engines of under 50-horse power. The first cost of an engine was the prime factor. The buyer looked at the initial outlay rather than at the working expenses. As to selling electricity at 1d. per unit, no company in New England could do it at the existing prices of steam coal. The gas-turbine was scarcely a practical thing yet. He gave examples of inefficient or uneconomical gas-engines, improperly constructed, that would not develop anything like the power that should be expected according to the size of the cylinder or length of stroke, and of machines said to be adaptable either to gasoline or gas that were not suited to the latter. He had some bitter experience as to the necessity for the gas company to have a hand as regards the horse power developed by an engine. He found that calculations based on dimensions or pounds of pressure evolved were useless. He quite agreed that gas companies should be able to deal with ordinary troubles or defects.

The Question Box.

Purification.

In the course of a discussion on purification, it transpired that with large vessels and the use of air or oxygen some advantage was gained by reversing the order of working every few days. This might mean reversing the flow, or simply the order of the vessels.

Texas Oil.

In reply to a question as to the permanence of gas made from Texas oil in the New England climate, Captain White said that no one had yet been able to so apply this material as to get a gas that would remain permanent at low temperatures. Oils of 26 to 29 sp. gr., with an asphalte base, were very different to deal with from the oils of Pennsylvania or West Virginia, which were of much higher specific gravity. It was found that cannel coal gas would stand cold much better than any oil gas; a mixed gas was much better than a straight carburetted water gas. Mr. Barnum used Texas oil, and found that 8 per cent. of the oil was deposited between the generator and the relief holder, and 4 per cent. before the purifier—making 12 per cent. altogether, and there was no deposit beyond the purifier. The specific gravity of the condensed oil was 34; and it distilled 10 per cent. at 150° C., and 40 per cent. at 300° C.

Electrolysis.

The present position of this trouble, and the best way of dealing with it, was discussed at some length. Mr. Witherby said there was considerable trouble in several towns in the States; and the difficulty was to get the parties who really caused the damage to admit responsibility. In his own town, there was a system of some 12 miles of track on which large heavy cars, perhaps 60 feet long, were run; and the manager said it was a matter of entire indifference to him how the current got back to the power-house. The rails were poorly bonded, and there was not a foot of return wire anywhere. So the water and gas pipes suffered badly, and there were services that had to be replaced every month. He had tried everything—lead pipe, galvanized pipe, &c.—but without effect. The few cases that had been decided in Court were simply compromises, and did not constitute precedents; and, in fact, the Judges seemed to wish to avoid a definite pronouncement. The position was becoming very serious, especially in wet soils; and he thought they would have to bring it to an issue. He instanced cast main pipes that were so rotted that they could be whittled through with a penknife. Where the trolley company showed willingness to properly bond their rails, and otherwise take care of the return current, he thought they could live peaceably together. He certainly did not believe in bonding or connecting the mains with the track. Mr. Hawkes said that in one instance some water-pipes exposed to outside salt water that gave great trouble were run to earth by means of a heavy copper wire bonded to a piece of railway iron and carried out into the sea. Since this was done, electrolysis had practically ceased. He also found jointing the mains with cement instead of lead to be a good plan. Mr. Gray said that where the current was weak, bonding or running to earth might be a help; but it was tackling the problem at the wrong end. The question was not how to carry off current, but how to keep it out of the mains in the first place. He had tried keeping the gas-mains charged to a potential sufficient to keep out the stray currents; but this was worse than useless. At Buffalo (N.Y.), he had 120 miles of pipe; and after spending £3000 or £4000 on a system of return feeders as advised by the electricians, he was worse off than before. Where previously they had 50 or 75 amperes, with the feeders they had 600 or 700; and they made up their minds that this was not the way out of the trouble. The plan that finally succeeded was breaking up the conductivity of the mains, and getting a resistance so high that the current would not overcome it; and he thought Mr. Witherby could meet the difficulty in a similar way. He introduced an insulating joint at intervals of 150 up to 800 yards or more, according to circumstances; and the average over the whole might be ten to the mile.

Effect of Temperature on Volume of Gas.

In replying to a question as to whether the usual correction of temperature at station or photometer meters was correct over a wide range of temperature, Mr. Hinman said that the usual correction of 1 per cent. for every 5° was all right if the gas was dry, or at least heated or cooled without taking up or depositing water; but where the gas had free contact with water, it was a long way out. To give an example, 1000 cubic feet of gas at 60° Fahr. heated out of contact with water up to 140° would expand to 1154 cubic feet; but if freely exposed to water, it would expand to 1410 cubic feet. At every increase, there would be a certain amount of water vapour taken up; and the increase was not regular, but varied with the temperature. It increased in a greater ratio than the temperature. Vapours of hydrocarbons had a similar effect; but the tension was different for each substance, and therefore with a compound like coal gas an accurate correction of temperature over wide ranges could not be made. Mr. A. B. Slater, jun., said that this touched on a question of condensation, which was not merely a matter of reducing temperature, but also of taking out the latent heat given out when vapours passed into the liquid state. Many people would be surprised at the number of heat units that had to be disposed of in bringing crude gas from 140° down to 60°; and if the gas were taken at 165° instead of 140°, the heat units to be removed would be almost double. In crude coal gas, about 90 per cent. of the total heat to be removed would be due to aqueous vapour alone.

High-Pressure Distribution.

"Are the high-pressure systems meeting expectations?" and "What is the effect of compression on candle power?" proved interesting topics. Colonel Richardson had operated with perfect success a high-pressure line 13 miles long for two months. The weaknesses, if there were any, had not yet developed. His pressures ranged from 18 to 7½ lbs.; and the effect on the quality of the gas was practically negligible—being only a small fraction of a candle. The pipe was partly 3 inches and partly 4 inches diameter, and was worked in conjunction with a storage reservoir. The practice was to raise the pressure to nearly 20 lbs., and then to stop the pumps till the consumption caused it to fall to 8 lbs. The gas passed through district governors, which reduced the pressure to 3 inches before being distributed. All moisture was deposited within half-a-mile of the works. Beyond this the gas was dry; and he believed there would be less trouble from frozen service-pipes than when supplying uncompressed gas. Mr. Woodward had 5½ miles of 4-inch and 4½ miles of smaller pipes, and supplied direct off them, using a governor on each service. This had been operating six months without giving trouble or showing weakness. During the winter, there had not been a single complaint or a frozen or stopped service. Mr. Shelton was more satisfied than ever that high-pressure distribution was a good thing, though perhaps not suited to all conditions. He could report excellent progress. He preferred individual to district governors, and did not consider there was any risk, even in large cities, in delivering gas at 20 to 30 lbs. pressure into the services. At Chester, he had 50 miles of high-pressure pipe, supplying 2500 consumers; and at New Orleans, 8 miles of high-pressure feeding mains. They had been in use for a year, and no trouble had arisen. In a 50 million feet works, the cost of compression might be 1d. per 1000 cubic feet; but on a larger scale it might be ½d. or perhaps ¼d.

PROGRESS IN GAS MANUFACTURE IN ENGLAND AND AMERICA.

At the recent meeting of the Ohio Gaslight Association, held at Cleveland, Mr. Irvin Butterworth presented his second "Progress Department Report," giving a *résumé* of the more important technical and mechanical improvements that have been made in gas manufacture, distribution, and consumption during the past year. This was in continuation of his first report made twelve months ago, noticed in the "Journal" for May 5 and 12, 1903.

Mr. Butterworth calls attention to the fact that the present report may seem meagre compared with his previous effort in this direction; but this is more than accounted for by the fact that the earlier report covered a period of five years, whereas the work of one year only is embraced in the present issue. As a matter of fact, he says the advancements of the past twelve months compare very favourably indeed with those of any preceding year in the history of the gas business, and their contemplation will dispel any misgivings lest the technique of gas manufacture and distribution is not keeping pace with the rapid progress being made in the commercial end of the business.

After giving a classification of the gas patents issued in the United States in 1903, Mr. Butterworth remarks: It is evident that there has been unusual interest and activity in gas invention during the past year on both sides of the water. Progress in the development of the gas-engine has been especially marked, due largely to its increasing use with producer and blast-furnace gases, but partly also to the expiration of the principal Otto gas-engine patents. Acetylene generators still constitute an attractive subject for the inventor; and incandescent gas-burners and appliances carried off third honours in this country in the number of gas patents issued. However, the greatest progress in the gas business is not necessarily in the direction indicated by the largest number of patents issued. The most important progress of the past year (aside possibly from that made in gas-engines) has probably been in gas-works plant and processes—particularly in respect to machinery for charging and drawing retorts, and for conveying coal and coke. The number of bye-product coke-oven plants is also increasing; and this system is a factor of growing importance in the matter of gas supply for the larger cities. Improved methods of distribution, including the high-pressure system, are being rapidly adopted; and out-door incandescent gas-lamps have been greatly improved and developed during the past year. The number and variety of industrial gas appliances are also rapidly increasing; and the scope and possibilities of this branch of the gas business have been strikingly shown by the recent publication by a Western gas company of an Industrial Gas Appliance Catalogue* which, by its magnitude and completeness, is a revelation to gas men themselves of the adaptability of gas to innumerable industrial purposes.

In last year's report, a list was given of a large number of industrial uses to which illuminating gas is being applied; and this list is now increased by including 37 additional appliances in which gas is employed. The report further states that some of the gas companies of America, including at least one large one, are now selling as large a proportion as two-thirds of their gas for purposes other than illumination, with a satisfactory increase also in the illuminating branch of their business. Another manifestation of the present tendency towards progress is the intelligent and careful attention which gas companies are beginning to give to the daily operation of their coal-gas benches with respect to the fuel consumption—the largest single item of gas-works expense. Until recently, flue-gas analysis, as a means of securing maximum fuel economy in gas-works, was almost unheard of and seldom practised; but now, and especially within the past year, many companies are making either daily or frequent flue-gas analyses, to their great advantage. The adoption of at least tentative standard specifications for testing fuel-gas appliances, which is a reform consummated within the past year, is a significant and important forward step. And last, but not least, there has been a marked and much-needed improvement in the working methods of some of the Gas Associations of America.

The above introductory sentences are followed in the report by a detailed account of the specific improvements of the past year, given under various headings.

Charging and Drawing Machinery.

During the past year, there has been great interest, progress, and development in all kinds of gas-works machinery, especially charging machinery. In this country, aside from the companies operating inclined retorts and bye-product coke-ovens, those in the following cities are now using drawing or charging machinery, or both, as shown by the following list: Charging machinery only: Montreal. Drawing machinery only: Cleveland, Indianapolis, Newark, Worcester, Buffalo. Both charging and drawing machinery: Cincinnati, New York, Toronto, Philadelphia, Mount Vernon, Detroit, Milwaukee. The following makes of machines are now in use in this country: Charging and discharging: Bronder, Ross, West. Discharging: Arrol-Foulis. Charging: De Brouwer.

Charging machines are now being operated in this country that charge four retorts simultaneously, and discharging machines are operated that discharge four retorts simultaneously. Combined machines are also being made that both charge and draw, as may be required, either three or four retorts simultaneously. In Europe especially, there has been great activity during the past year in the development of charging and drawing machinery. The latest forms of charging machines do not convey the coal into the retorts, but "project" it in, either by centrifugal blowers, turbines, or fans, or from a rapidly moving belt. Retorts 20 feet long are being successfully charged in this way, notably at La Villette works of the Paris Gas Company, where an electrically-driven turbine projector is used. The De Brouwer projector is in operation in the cities of Bruges (Belgium) and Derby (England), and perhaps elsewhere. It is electrically driven, and throws the coal into the retorts from a rapidly-moving horizontal belt, on to which the coal is fed from an elevated hopper. A machine of this make is now also being used—experimentally at least—in New York City. A firm in Stuttgart are also building what they call the "Kobold" charger,† which can also be operated by electricity, and which throws the coal into the retorts by a system of rapidly-revolving fans. Other types of centrifugal projectors for charging retorts are also being perfected, such as the Fiddes-Aldridge and West machines, both patented in England last year. The claimed advantages of this general method of charging are that (1) it is adapted to small gas-works; (2) the coal is placed with absolute evenness and nicety in the retorts; and (3) retorts of any length, within reasonable limits, can be charged by the same machine.

There seems to have been less activity in the development of discharging machinery than of charging machinery; but a notable improvement in the former is the discharging rams now used at La Villette works in Paris, and in Derby (England), which pushes the coke out of the through retorts from one end. Notwithstanding the retorts are 18 and 20 feet long, the coal is charged with such evenness by the turbine and belt projectors that the coke can be easily pushed out in this manner, as it could not be with any other system of charging. Furthermore, the retorts can be almost completely filled with coal—resulting in obvious economies and advantages. In these works, the projector is operated at one end of the retorts and the discharging ram at the other.

Inclined Retorts.

The advance made in machines for charging and drawing horizontal retorts has rendered the wisdom of installing inclined retorts still more doubtful than it was a year ago. Engineers are proceeding cautiously; and it seems to be the part of conservatism just now to await the developments of the immediate future before adopting on a large scale either of the two systems, although the chances are apparently in favour of the horizontals. In England, only seven patents pertaining to inclined retorts were taken out last year; and only one of them refers to the retorts or settings proper, the others pertaining to buildings, conveyors, &c. Only four inclined retort patents were taken out in the United States during the past year; and they were obtained by foreign inventors. However, some notable advances have been made during the year, both in this country and in Europe, in the utilization of old retort-houses with low roofs for the installation of inclines that were previously supposed to absolutely require high roofs. During the past year, the inclined retorts built during the previous year at Lynn (Mass.) have been put into successful operation; and inclined installations have been built during the year at New Bedford (Mass.) and Lynchburg (Va.); the latter being the smallest installation of inclines in the country—viz., three benches of sixes. A low-roofed retort-house is used, and the retorts are to be heated by producer gas made in isolated producers outside the building. The Consolidated Gas Company of New York City are about to install an inclined-retort plant having a daily capacity of 10 million cubic feet.

Through Retorts.

With the advent of improved charging and drawing machinery, there are evidences of a revival of the through retort construction. One retort builder in this country is now prepared to erect through retorts 20 feet long, adapted to the use of a charging machine at one end and a discharging ram at the other.

Vertical Retorts.

An interesting and promising experiment has been in progress during the past eighteen months at Exeter (England), with the revival of an old idea of placing the retorts in an upright, instead of in an horizontal, position. Only one such retort was originally installed for the purpose of this experiment; but the results were so favourable that an installation of six such retorts is now being made at these works. The coal is fed into the retort by a plunger, which introduces about 6 lbs. of slack every 100 seconds. This installation is what is called the Settle-Padfield system. Another system of vertical retorts is also about to be tried in England; while a third installation, on still another system, has been determined upon at one of the Berlin Gas-Works. The results at Exeter indicate that an increased yield per ton of 2000 to 3000 feet of gas may eventually be secured by the vertical system.

Small Retorts.

During the past year, a multitubular retort setting was patented in England, contemplating the placing of a large number of very small horizontal retorts in one bench, with a view of obtaining higher yields and better qualities of gas. A bench of twenties has been installed at East Greenwich.

Bench Construction.

One bench builder has perfected plans for benches of horizontal eights so constructed that he claims that no clinker will be formed, and that there will be no danger of cracking flue-tiles while renewing the retorts and settings. The subject of better grades of fire-clay goods for benches is being agitated by several companies; and there will doubtless soon be much improvement along this line, as, indeed, there has been during the past year. One manufacturer is already putting four different kinds of materials in his bench work, varying the quality according to the usage or exposure to heat to which the various parts are likely to be subjected. A new form of recuperator tile has also been patented in this country, the tiles being interlocked, thus protecting the joints and making a simple, solid, and tight construction. The Crystal Palace District Gas Company, in London, are now making their own fire-brick and fire-clay specials, with apparently economical results. The main flue in inclined benches is now being placed inside instead of outside the benches, thereby economizing floor space.

* See "Journal," Vol. LXXXV., p. 140. † *Ibid.*, Vol. LXXXIV., p. 45.

There have been some improvements in the ironwork of benches during the year, particularly as to the method of anchoring the buck-bars at the bottom and tying them together at the top. Attempts are being made to standardize and reduce the number of different sizes of mouthpieces. Two or three companies having retorts in vertical rows have connected each row of mouthpieces with one straight standpipe, which greatly facilitates the cleaning of the standpipes. One of these companies has a patented pneumatic standpipe cleaner for cleaning these straight pipes. It is suspended from the roof trusses, and is very successful in its operation—keeping the standpipes perfectly clean with a minimum of time and expense. A new device has been perfected during the past year for scurfing retorts. It involves the simultaneous introduction into the retort of a combination of steam and compressed air; and by its use the carbon in a retort is loosened up in less than one hour.

Coal and Coke Conveying Machinery.

There has been considerable progress during the past year in the development of telpherage and other systems of conveying coal and coke. A moveable telpher-track now permits the storing of coal or coke in either rectangular or circular spaces, and taking it from same to boilers, &c. Coke-conveyors combining the use of exhaust fans for withdrawing the steam and smoke—the coke being quenched while in the conveyors or otherwise—have been improved during the year. The application of electricity to conveyors handling coal, coke, and ashes in straight lines, curves, and up grades, is a development of the past year. The cost of maintenance of conveying machinery is being decreased, as well as the power consumption. In one works, all the coal and coke products are handled automatically by electric motors. During the past year, one gas-works in this country has installed an electric storage battery locomotive for handling the cars on the tracks in and about the works.

Tar, Naphthalene, and Cyanogen Extractors.

There have been improvements in the drum of the "P. and A." tar-extractor; and other forms of tar-extractors have also been improved somewhat. Two different concerns in this country are preparing to build naphthalene extractors. The reversible condenser invented a few years ago by Mr. Charles Carpenter, of the South Metropolitan Gas-Works, London, for the extraction of naphthalene, is still in successful use. No American gas companies are as yet recovering the cyanogen from their gas, although one concern in this country is prepared to build apparatus for the purpose. There seems thus far to be more theorizing than practice, the world over, in the matter of the extraction of cyanogen. Authorities are still arguing as to whether cyanogen can be produced more cheaply by synthetic methods than by extraction from gas; and certain other authorities are warning gas men of the limitations of the world's market for cyanides.

Ammonia Washers.

Every year seems to mark some improvement in ammonia washers as made by the various manufacturers. One concern has just brought out a washer that seems to carry the refinements of this apparatus further than ever before, subdividing the gas into extremely small jets, giving it a double washing, and yet permitting so slow a velocity that but little entrained water is carried forward with the gas. Washers of other makers have been similarly improved. The rotary brush scrubber has also been improved in some details, such as the adjustment of overflows to prevent the liquor in one chamber from mixing with that in the next, means for the quick renewal of the brushes, and so improving the brush construction as to increase the actual scrubbing surface.

Water-Gas Apparatus and Processes.

During the past year, one manufacturer has improved his carburettor by making it of larger diameter (the same size as the generator), and placing the up-take flue inside the carburettor, instead of outside as heretofore; the bottom of the flue constituting a large ash-receiving chamber, which is fitted with a cleaning door at the bottom. This improvement enables the carburettor and superheater to be placed closer together, permitting shorter connections and making a neater appearance. A blast-box is now placed on the side of the shell immediately above the internal flue, from which the air is forced in at a right angle with the ascending generator gas, contributing to a uniform distribution of the combustion over the entire surface of the chequer-brick. The former divided blast arrangement has been further improved by the addition of special steam distributors between the bearing bars, insuring uniform distribution of the steam under the entire surface of the grate. Another firm of water-gas apparatus manufacturers have brought out what they call a "twin generator apparatus," for the manufacture of low-grade water gas. A useful and suggestive paper was presented during the past year by Mr. G. W. M'Kee, to the Canadian Section of the Society of Chemical Industry, on "The Economic Admission of Steam to Water-Gas Producers of the Lowe Type." The author calls attention to the economical results to be obtained by gradually diminishing the admission of steam during the run. During the past year, the claimed advantages of the Lewes system of passing blue water gas through coal-gas retorts during carbonization have been challenged; and Mr. Walter R. Jones, once Engineer of the Rome Gas-Works, has patented a method of gas manufacture that exactly reverses the Lewes method, in that he introduces coal gas into the water-gas generators, where the mixing of the gases takes place, and the combined gases are then passed to the superheating chambers, where the hydrocarbons are fixed in gaseous form. It is claimed that economies are thus obtained by the enrichment of the gas with the hydrocarbons of the tar. I have obtained no data as to improvements in the Dellwik-Fleischer system of water-gas manufacture; but the following quotation from a paper contributed last October to "The Engineering and Mining Journal" will be of interest: "The water-gas plant mostly used in Europe is the Dellwik-Fleischer system, over eighty plants of that type being in continuous operation. By this process, water gas costs less than by previous processes; the yield being 35 to 40 cubic feet per pound of coke or anthracite. The working of the apparatus is safe and simple."

Purifying Boxes and Apparatus.

Each passing year shows some advance in purifying apparatus. The use of dry-seal boxes is increasing, and considerable improvement is being made therein. The placing of purifying boxes out of doors is also increasing, two large gas companies in this country having built such outside boxes last year, leaving them entirely unprotected and exposed to the weather, with no bad results. The fact seems therefore to be still further established, that purifying houses are unnecessary. An English gas company has effected a saving of 10 to 15 per cent. in first cost of the usual four-box construction, by leaving no space between the boxes, and by putting the centre-valve above the boxes where the four inner corners meet. A large gas company in this country erected during the past year an outdoor box of novel construction, resembling the upper lift of a gasholder. No iron whatever is used in the interior of the box; the usual trays being dispensed with, and the oxide being supported by wooden slats resting on wooden supports. The box is filled and emptied through doors in the side. In two other American cities, novel forms of purifying trays were introduced, consisting of two layers of boards placed flatwise; the two layers being separated by cleats or slats of wood, and the boards in the top layer covering the joints or spaces between the boards of the bottom layer. A large manufacturer of trays reports that the tendency is strongly toward heavier trays, 1½ inches to 2 inches instead of 1 inch, as formerly. Cement purifiers were built during the past year in two or three cities in this country, saving their owners from 33⅓ to 50 per cent. in first cost, as compared with the usual iron-box construction. Improvements in valves and systems for reversing the flow of gas through the boxes have been made during the past year; these systems now being made very flexible, permitting the handling of the gas in a great variety of ways as circumstances may demand.

Photometry.

There seems to be nothing new in the way of photometry beyond the increasing interest in the Simmance-Abady "Flicker" photometer, the principle of which was discovered by Professor O. N. Rood ten years ago, but the photometer itself not having come into prominence until within the past year or two. It is a very interesting instrument, said to reduce the "personal error," and to enable the operator to accurately measure the relative intensities of two sources of light of different qualities or colours. The increasing use of incandescent gas lighting and electric arc lighting has made a photometer of this sort a desideratum. Only one of these instruments, so far as I can ascertain, is now in use in this country; and the operator is by no means pleased with it, although foreign gas journals and gas men speak very highly of them. The International Photometric Commission are still engaged upon the task of fixing upon a standard method of photometry, but thus far seem to be doing preliminary work. There is now being perfected in this country a device for making rapid candle-power determinations; but as it is not yet complete, no report can be made upon it at the present time.

Since the above was in type, I have received the following from Professor C. P. Matthews, of Perdue University: "Marked progress has been made in industrial photometry during the past year. The advance has been along two lines—namely, the perfection of photometric methods and the establishment of a working standard of light. Improvement in photometric methods has been chiefly in the perfection of photometers which yield the mean spherical candle power at one sitting, thereby shortening the process of making a spherical measurement from several hours to as many minutes. As the spherical candle power of the light source is, after all, the true measure of its efficiency as an illuminant, this must be considered as a marked step in advance. With reference to the second line of progress, it may be said that the Electrical Testing Laboratories, in New York City, are issuing standardized incandescent lamps that yield a candle power in close accordance with the Reichsanstalt standards, which are accepted as the most reliable in existence. The situation as regards a primary standard of light remains unchanged; but pending the development of a satisfactory primary standard of light, we are able to maintain, thanks to the National Bureau of Standards at Washington and the New York laboratories above referred to, a working standard of light that will have all necessary constancy and ease of reproduction."

(*To be continued.*)

REGISTER OF PATENTS.

Internal Combustion Engines.—Clerk, D., of Ewhurst, Surrey, and Bradley, H. W., and Bickerton, H. N., of Ashton-under-Lyne. No. 28,827; Dec. 30, 1902.

This invention relates to gas or other internal combustion engines, and is particularly applicable to large engines.

In such engines as at present constructed, it is said that difficulties arise because of the high maximum temperature of gaseous explosion ordinarily used and the high mean temperature of the gases while expanding in the cylinder. Such difficulties, for example, as pre-ignition are common in large engines; and unequal strains produced by the heat-flow through the sides of the cylinder and piston sometimes cause troublesome fractures. In many large engines the mean pressure is kept low for the purpose of reducing the mean temperature within the cylinder. In this way some of the difficulties of pre-ignition and fracture are overcome; but this involves reduction of power for a given weight of engine.

In order to reduce the mean temperature within the cylinder while maintaining a high average pressure, the patentees propose to add a volume of elastic fluid—such as air or products of combustion—to the charge before combustion. In the case of air being employed, this involves the presence of an excess of air over that required for normal combustion. It is found, for example, that when such a volume of air is added to the charge before combustion, the temperature attained in the cylinder is much reduced without reduction of the average pressures; and it is thus possible, working with the same maximum temperature, to employ much higher average pressures, although it is preferred to somewhat reduce the maximum temperatures at present used. This invention also consists in so arranging the operations of the cycle as to allow the hot gases the minimum possible period of contact with the enclosing walls of the combustion space, cylinder, and piston; and, further, to provide a special method of scavenging the exhaust products.

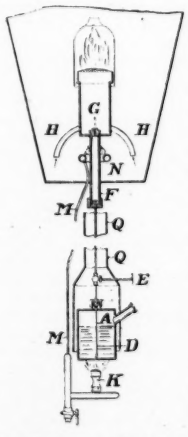
Manufacturing Incandescent Mantles.—Grundy, F. B., of Marple. No. 10,852; May 13, 1903.

Many attempts have been made, says the patentee, to produce mantles for incandescent gas lighting by the impregnation of knittings made from ordinary artificial silk; but after burning off the organic matter, the oxides composing the mantle have been left in a very fragile condition, and have in nearly all cases fallen into holes from the fact that artificial silk, such as has been used up to the present, consists of a number of separate filaments lying side by side and only twisted together to a very slight degree—thus lending practically no support one to the other. In order to overcome this difficulty, he proposes to twist the filaments composing the artificial silk together, in a manner similar to the way in which cotton yarn is twisted in order to produce knitting cotton, and thus form a cord of two plys, three plys, or any desired number of plys. He then knits the cord into a suitable shape, and impregnates it in a solution of the salts used in incandescent gas lighting—such solution preferably containing from 10 to 20 per cent. of the oxides, the exact strength of the solution depending upon the thickness of the artificial silk cord and the weight of the mantle it is desired to produce.

The mantle is then dried; and if the salts used have been nitrates, the dried impregnated mantle is submitted to the action of ammonia, either by suspending the mantle in the fumes of ammonia gas, or by soaking it in a strong solution of ammonia gas dissolved in water, in order to convert the nitrates into hydrates. In this way, when the mantle is being burned off the organic matter is consumed slowly and regularly, and thus as little strain as possible is placed on the mantle at this critical stage of the manufacture." After again drying the mantle, it is ready for burning off in the usual manner.

Carburetting Air by Naphthalene Vapours.—Lion, G. P. J., of Paris. No. 11,561; May 21, 1903. Date claimed under International Convention, May 21, 1902.

In patent No. 5805 of 1903, apparatus was described for carburetting air by means of naphthalene vapours for heating and motive power. The present invention relates to the utilization of the same vapours for lighting, either by incandescence or by direct combustion.



Having chiefly in view the lighting of towns, the patentee states that he conceived the idea of utilizing the gas just as it circulates in the pipes whenever possible. For this purpose, he arranges in the base of the lamp-post a tightly closed reservoir A, provided with a filling pipe and an immersion pipe D, connected with a pipe running up in the lamp to the vaporizer and furnished with a plug E. F is a rectilineal tubular vaporizer, through the lower end of which the liquid naphthalene enters and is discharged, in the form of vapour, through the upper end by a regulated injector. The vapour enters a bunsen pipe G, surrounded by a mantle and furnished with air-intake pipes H.

The first heating of the reservoir A is effected by means of a burner K branching off from the gas-supply pipe. A small tube M—likewise branching off from the gas-supply pipe—runs up into the lamp to a small gas-burner N, preferably of annular shape, which surrounds the vaporizer, so as to keep it constantly at a temperature sufficient for converting the naphthalene into vapour. The reservoir is enclosed by a casing, which has an extension Q that acts as a chimney, through which the naphthalene pipe runs. In this way, the combustion gases from the burner K keep the naphthalene in the supply-pipe in a liquid state while the lamp is burning.

The necessary pressure for raising the liquid to the vaporizer F and projecting it into the bunsen pipe may be produced by one of the numerous known methods; but the simpler plan is to utilize the pressure of the naphthalene vapours themselves, by raising them to a sufficiently high temperature—that is to say, about 250°C. Boiling taking place under atmospheric pressure at a temperature of 220°C., a pressure of about 1 kilogramme per square centimetre (amply sufficient in most cases) is applied to the reservoir.

In order to start the apparatus, it is only necessary to light the burner K and the vaporizing burner N; and after a time the reservoir A will acquire the maximum temperature. The plug E is then opened, and the vapours ignited above the mantle in the usual way. The action continues without change while any naphthalene remains in the reservoir, or as long as the plug E is not closed. In towns without gas-works, spirit burners may be used instead of the burners K and N.

If the bunsen pipe and its mantle be dispensed with, and the vapour be injected by one or more "Manchester" burners (or burners like those employed for burning acetylene), the naphthalene vapours, the patentee points out, burn "in the form of exceedingly brilliant and luminous flat flames." In these cases, as the pressure required is not so great as for use with incandescent mantles, the naphthalene reservoir may be suspended in the lamp. The liquid is conveyed by a single vertical pipe to an inverted double arm burner, so that the pipe and the two arms of the burner are heated by the flame itself.

Preventing the Choking of Ascension Pipes.—Gibbons, W. P. & G. B. A., of Dudley, and M'Ewen, C. J., of Liverpool. No. 11,103; May 15, 1903.

The arrangement proposed to carry out this invention is shown as applied to both inclined and horizontal retort mouthpieces. Fig. 1 is a sectional side elevation of the mouthpiece and lower part of an inclined retort with the coal-stopper suggested to prevent choking of the ascension pipe. A plan of the stopper is also given. Figs. 2 and 3 are sectional elevations of the mouthpiece and end of a horizontal gas-retort with the invention applied thereto in two different ways.

Fig. 1.

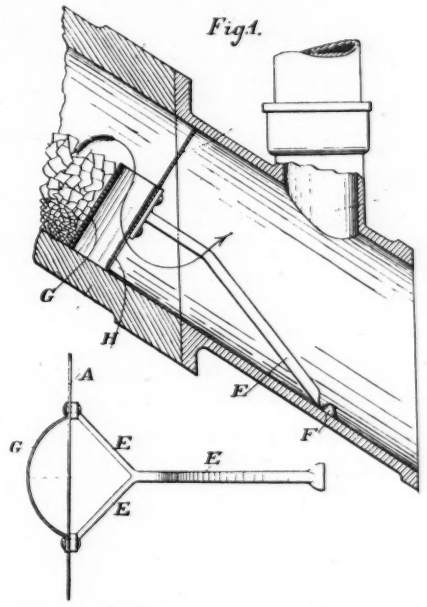


Fig. 2.

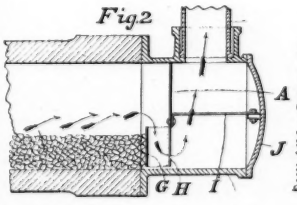
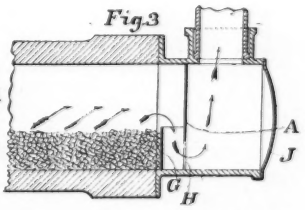


Fig. 3.



According to fig. 1, the coal-stopper is made in the form of a plate A, of the same shape and practically fitting in the retort mouthpiece, and situated some little distance higher up the retort than the outlet to the ascension pipe. The plate of the coal-stopper has the backwardly projecting leg E, which takes against a stud F on the bottom of the mouthpiece. In the lower part of the stopper there is an opening H for the gas to pass through; and the front of this opening is covered by a second plate or part G, which is fixed to the coal-stopper, and is bulged outwardly therefrom and extends upwardly from the bottom of the coal-stopper to some little distance above the level of the charge in the retort. As the coal is carbonized, the gas soon deposits tarry matter round the edge of the stopper, where it fits in the retort and mouthpiece, and thus closes any small passages there may be; and then the gas can only reach the ascension pipe by passing down at the back of the curved part G, and then through the opening H (as indicated by the arrow) and up to the ascension pipe. This tortuous passage of the gas has the effect, it is said, of causing it to deposit the bulk of its tarry matter in the lower part of the mouthpiece of the

retort, where it gives oft a light tarry vapour, which, in passing up the ascension pipe, has the effect of keeping the inside moist and preventing the deposit of carbon; or, if the carbon is deposited in the ascension pipe to any extent, then, owing to the tarry deposit on the pipe, the solid carbonaceous deposit becomes detached and falls down into the mouthpiece, and thus the ascension pipe is effectually prevented from becoming choked.

When the invention is applied to a horizontal retort, the baffle-plate A (fig. 2) is carried by links I from the door J inside the retort mouthpiece as before. It has the opening H in its lower part, and also the second plate G in front. The links I are made long enough to carry the baffle-plate into the mouthpiece in front of the ascension pipe, so that the gas can only reach the ascension pipe by first making the tortuous passage over the upper edge of the front plate G and down through the opening H in the plate, and then up to the ascension pipe as shown by the arrows. Instead of the baffle-plate A being carried by the links I from the door, the links may be dispensed with, and the baffle-plate be constructed as shown in fig. 3.

Drawing Gas-Retorts.—Bollé, C.; a communication from C. Eitle, of Stuttgart. No. 22,335; Oct. 16, 1903.

This invention was described and illustrated in the "JOURNAL" for the 5th inst., p. 27. It is an arrangement of drawing apparatus for horizontal retorts, consisting (in the words of the patentee) of two helical conveyors, of suitable section, wound preferably in contrary direction; the contrary direction of their rotation, and the position of the threads relatively to each other, being such that a large area of the retort bottom is reached by them, the coke is detached from the bottom, and cut into pieces upwards, and the several pieces are pushed backwards in the spaces formed by each two coils, "whereby a rapid and clear discharge of the retort on its entire length is assured without any appreciable disintegration of the coke into small pieces." In any case, this disintegration is said to be not greater than that necessarily produced by drawing the coke about twelve times with rakes by hand, and especially by power. The means for producing the rotation of the conveyors may be mechanically connected with the means for advancing them into the retorts, and may be operated by hand or motive power.

Connecting Gas-Pipes in a Gas-Tight Manner.—Klinger, R., of Gumpoldskirchen, Austria. No. 3351; Feb. 10, 1904.

The patentee claims the discovery of a method whereby a perfectly gas-tight connection can be made in pipes intended to be screwed together by means of connecting parts, as well as in pipes which are intended to be connected directly with each other, and which have their ends formed in the usual way—that is, the end of one pipe length is formed with external screw-threads, while the end of the other pipe is formed with internal screw-threads adapted to engage with the external screw-threads.

Before screwing the two pipe lengths together, a layer or coating of solder is to be applied to each screw-threaded portion throughout its entire extent, and then the ends of the pipes, or the connecting parts, prepared in that manner are heated and screwed together. This may, it is said, be done by squeezing the ends of the pipes and connecting parts between the heated copper jaws of a tongs or other suitable device, each part being pressed separately by the tongs, for transmitting the heat from the tongs to the pipe.

APPLICATIONS FOR LETTERS PATENT.

8265.—M'INTYRE, T., and HENSHAW, C. T. A., "Gasaliers." April 11.
8311.—KURZWERNHARDT, A., "Siemens regenerative furnaces." April 11.
8322.—TWOMBLY, W. I., "Self-heating hydrocarbon gas-generator." April 11.
8325.—BUHLMANN, G., "Incandescent mantles." April 11.
8394.—RUSS, C., "Operating gas-cocks." April 12.
8447.—KEARNEY, E. W. C., "Gas-burner controllers." April 13.
8451.—VINEER, R. H., and CARLYON, E. L., "Mantle holder." April 13.
8471.—ANDERSON, W. & H., "Inverted burners." April 13.
8492.—HODGE, J., "Gas purifier and grids." April 13.
8554.—MORRIS, M., "Gas-burner." April 14.
8640.—REDMAN, T., "Purifying gas." April 15.
8659.—ASHBY, C. J., "Gas-retorts." April 15.
8682.—FIRTH, A., "Gas-burners." April 15.
8689.—HUNTER, W. D., and BARNETT, W. A., "Discharging retorts." April 15.
8738.—M'ILQUHAM, F., "Gas-producing plant." April 16.
8827.—TONKIN, W. W., and PUPLETT, "Producer gas." April 16.

New Reservoir for the Southport Water Board.—The Southport, Birkdale, and West Lancashire Joint Water Board have confirmed the plans for a new service reservoir at Gorse Hill, Aughton. It will be situated about a mile from Ormskirk, close beside the present reservoirs, and will have a capacity of 4 million gallons. The reservoir will be 211 feet long and 198 feet wide; and there will be a depth of 18 feet of water. The total cost will be from £22,000 to £25,000.

Bombay Gas Company, Limited.—The accounts to be presented at the meeting of the Company on the 5th prox. show that the balance on the profit and loss account is £18,358, which makes, with the amount brought forward (£462), a total of £18,820. Out of this, owing to the re-adjustment of value on the basis of 1s. 4d. to the rupee, the former excess in nominal value of outstandings in Bombay, amounting to £3178, has been written off, forming a special charge which will not recur. After allowing for the interim dividend paid in December last (£7200), the balance available for distribution is £8442. The Directors recommend a dividend of 3½ per cent., free of income-tax, making 6½ per cent. for the year, and carrying a small balance forward.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Stops—not Slots.

SIR,—May I, as the writer of the articles on "Stops—not Slots," step from the neutral zone in this matter for the nonce, and into your "Correspondence" columns, because, you know, for the opinions there expressed "we are not responsible." I desire to do so in the interests of discussion, and in order that I may refer to Sir George Livesey's letter in last week's "JOURNAL" (which letter should have been headed "Slots—not Stops") in a manner which may produce from him and others some profitable controversy.

My first remarks have nothing to do with Sir George's letter; but they have relation to the term "neutral" which I have deliberately employed above, and for this reason—that there are (but it is a pleasure to believe only) a few who, from some inscrutable cause, possibly through not giving the matter sufficient consideration, will confound a descriptive article or series of articles picturing the experiences of others as the determinate views of the "JOURNAL." To such, allow me to say that such articles should be looked upon as a picture, for the painting of which the whole of the materials are supplied. An artist can only paint with the colours he has at command. So in the case of the articles on "Stops—not Slots," these constitute the picture of experience with the two prepayment systems in Croydon—not anywhere else. The experiences are singular, because "stops" (to the best of my belief) have not been tried on precisely similar lines elsewhere. If any reader has any singular experience in connection with slots in comparison (under similar conditions) with some other system of supply, I have no doubt, Sir, that you will permit his experience to be painted in the most vivid colours that that reader chose to hand out, provided that the materials are found to be of the proved soundness of those received at Croydon.

But to my subject. I will make the confession that, as the result of careful investigation, one of the articles of my gas creed now is that, *under the conditions existing at Croydon and with (speaking generally) the same class of consumer as is found there*, for such conditions and for such consumers the stop meter is a better system than the slot. Does this confession, however, debar me from exercising my judgment and saying that, given other conditions and a different class of consumer, the slot-meter is the preferable system. I think not.

However, turning to Sir George's letter. Naturally, I have read it with considerable pleasure—pleasure because, underlying his little raillery as to the two articles having occupied eleven columns, there is abundant evidence in the letter that those eleven columns have afforded Sir George some interesting reading. That is a sufficient reward. But the eleven columns is a point to be defended. A subject that concerns every gas undertaking in the kingdom, and in every district consumers ranging in numbers from hundreds to many thousands, I place on as high a level as—supposing, I say, the labour question as affecting gas workers, to which question (and deservedly so) many, many columns of the "JOURNAL" have been devoted through speech and article, and which columns have been perused by me with the sympathetic interest of one who, in years gone by, through church work, was brought into very intimate contact with those whose daily bread is earned by the work of their hands, and consequently with those of our social system who now form, in the gas business, the prepayment consumers. If I were to apply the experience then gained to discriminating between the two prepayment systems for gas supply, the choice would, assisted by present knowledge, deliberately fall upon the stop meter. (That would mean perhaps another two columns, Sir George!) Quite apart from what is in my mind in this regard, the gas business is not a philanthropic institution; it is a business in which, no matter whether the purchase be large or small, each consumer should contribute a profit commensurate with, first, the initial expenditure that he occasions within his premises, and, secondly, with his proportion of the gas consumed. If, however, it is so desired, even the "very poor" of whom Sir George speaks can be, under the stop-meter system, more generously dealt with than under the slot system. Does he not see that, under the former system, the expense of the installation could, if he wished to treat that part of the prepayment consumers more favourably than others, come from the profits of the shareholders, rather than from the pockets of fellow (but more profitable) prepayment consumers, whose possession of this world's goods may be but little in excess of that of the "very poor"? Within my own observation, the measure of a prepayment consumer's gas consumption must not be taken as the measure of his poverty, or otherwise.

Sir George does not dispute that, in respect of fairness, the stop-meter system is, or can be made, the more perfect of the two; but he suggests, as a means of ensuring fairness with slots (though few companies would bring this to the notice of those concerned) that the large slot consumer, whose consumption is in excess of the amount required to pay a fair interest on the capital expended on his account, can have an ordinary meter, paying the ordinary price, *plus* the usual rent for meter, stove, and fittings. The consumer wants to prepay. The fact that he has the slot meter makes that manifest. Why, then, should he (good prepayment consumer that he is) be compelled, in order to obtain justice, to have recourse to the, to him, objectionable quarterly account? The stop meter comes in there as a far preferable remedy. And, believe me, some (not all) of these large consumers under the slot-meter system are the very ones who want to be defended against themselves—against their own extravagance, not only in gas, but in other ways; and, in such cases, the quarterly account, *plus* the rent for meter, fittings, and stove, would cause both the gas suppliers and the consumer no end of worry and inconvenience. However, Sir George believes that "for the great bulk of slot-meter consumers the average payment is not far wrong." The articles which have given rise to this correspondence were written on the experience of Croydon. For my answer to this, Sir George is referred to the table on p. 80 of the "JOURNAL" for April 12.

In the second paragraph of his letter, Sir George draws an inference from very incomplete premises. To him the stop meter does not "seem" so popular with the consumers as the slot. The consumers who have tried both systems may be permitted to judge for themselves; and both from Carshalton and Ramsgate, the testimony comes that consumers who have been under the "stop system," and are then through removal brought under the slot system, frequently ask to be again placed under the former. They like it better. But let us see. Sir George arrives at his conclusion because the prepayment consumers in Croydon only equal 77 per cent. of the number of the ordinary consumers; whereas, within his experience, he knows of some companies who have reached 100 per cent. and more. Fie! fie! Does not Sir George know that the extent and character of a crop—cereals, fruit, flowers, or anything else—depends very largely on the soil? No two districts can be compared as to the progress of the prepayment system unless we know the proportion of the (in the absence of a better expression of classification) working-class population to the middle and upper classes. Sir George knows the Croydon and Carshalton districts well; and he knows his Crystal Palace and South Metropolitan districts. Just as the South Metropolitan district has been a better field for the cultivation of the prepayment consumer than the Crystal Palace district, so is the latter a better district than the Croydon. It is unfair to compare Croydon with South London; and yet as we get nearer to like, though still superior, circumstances for prepayment consumers, it is found that out of a total of 32,778 meters in the Crystal Palace Gas Company's district, only 14,987 are slot consumers; the remainder being ordinary. In other words, the percentage of the slot to the ordinary is 84 in the Crystal Palace district, as against 77 in Croydon. Knowing both districts, and considering the character of the populations, it is a matter of surprise to me that the difference is not greater. Why is it, with Sir George in the chair, the percentage of the Crystal Palace Company is not up to that of the South Metropolitan Company? The answer is the difference in the districts. In these things, we must be careful to compare like with like; and therefore, I hold, that Sir George's inference in regard to popularity is far from justified. Besides which he leaves unnoticed the fact that the Croydon Company have not specially pushed the prepayment system—the growth being for them at a sufficiently rapid rate without.

As to the references to cooking-stoves in Sir George's letter, the Croydon experience with slots does not agree with his, that there is only "a small proportion" who do not use sufficient gas to pay a fair rent on the meter, stoves, and fittings. For proof, refer again to the table on p. 80. It would be instructive if we could have some corresponding figures from the Crystal Palace Gas Company's district. My reason for suggesting this is that the accounts of the Crystal Palace Company inform me that of 14,987 slot consumers, 12,370 have stoves (for interest it may be added that only 9212 of the 17,791 ordinary consumers have them). The 12,370 is a considerable percentage on the 14,987; while only 50 per cent. of the stop-meter consumers in Croydon have stoves. Yet the *average* consumption of gas by the stop-meter consumers, half with stoves and half without, is between 18,000 and 19,000 cubic feet. The figures asked for above, with the average, from the Crystal Palace Gas Company would therefore be of great interest in this comparison. As to Sir George's point regarding the rent for the stove, he does not take into calculation the 9s. 3d. for fixing. As an ordinary consumer in the Crystal Palace district, I have a stove which (if my information is correct) would cost a gas company about £3 6s. I paid for the fitting, and am charged 9s. a year rent. Therefore the stop-meter consumer in Croydon is not much worse off than I am; and if rightly informed as to the cost of my stove, the Croydon Company are not alone in charging more than "the usual 10 per cent." However, that by the way. That there is not much wrong about the total charge in the case of the stop system is seen by the tabular comparison in the last paragraph of the section of the second article dealing with "Capital and Depreciation." In discussing this question of the stove, Sir George ignores altogether the question of the capital expenditure on those stoves that are used insufficiently to produce a fair interest on the outlay. The cooking for 52 Sunday dinners will not produce it; a griller would in all probability yield in those cases, considering the smaller capital expenditure, a far greater profit to a Company.

Towards the end of his letter where Sir George sees in the change something "approaching an injustice," there is a little sophism here. Supposing two men are set to work filling barrows, one fills 10·81 in a given time, the other only 9, and the 9 do not pay the employer, there exists an injustice to the former man and to the employer. Is the rectifying of this, doing an injustice to the man who fills only 9? Sir George apparently thinks so. Apply the same reasoning to the 8548 stop-meter consumers (paying a fair amount, as shown by the last tabular statement referred to) and the 757 consumers who, at Dec. 31 last, were not, on the average, paying a fair sum; and it will not be difficult to see where the injustice really exists. Sir George finds the 1·81d. to be the only advantage to the Company. If he re-reads the second article, and jots down the advantages, there will be a fairly long list.

Yet, after all, there are many districts in which "the slot meter with its pennyworths of gas is a great convenience." But I am not convinced by Sir George that Croydon have not done the right thing in their particular circumstances.

Kindly pardon this addition to the eleven columns!

THE WRITER OF "STOPS—NOT SLOTS."

SIR,—As the introducer of the "stop" (although but little interested in its manufacture), my views on the above question might naturally be credited with carrying prejudice; and I do not therefore propose to refer at the present juncture to the merits or demerits of either. It seems to me, however, that in discussing the question it will be helpful if the circumstances surrounding the introduction of the prepayment system were considered, which made the use of either the stop or slot possible. These thoughts are suggested by the last paragraph of Sir George Livesey's letter in the issue of the "JOURNAL" for April 19: "I therefore stand by the slot as having been the means of causing by far the greatest development in the use of gas that the industry has ever experienced during the whole course of its eventful and beneficent history."

In my opinion, this paragraph does not go to the root of the development to which Sir George Livesey calls attention. The piping of houses and the supply of fittings to consumers who were until that time outside the reach of a gas supply is the real secret of the development and enlargement of a gas company's business. The use of a stop or slot meter is an incident in that development, and only deserves consideration in that light. Indeed, for two years before the invention of the stop meter, gas was supplied under this system by the use of an ordinary meter and short payments; the inconvenience attaching to an ordinary meter first directing the attention of the writer to a simple mode of construction to check and stop the consumption at any given point. The pioneer Corporation [Ramsgate] which first introduced the system and the stop meter, supply a much larger number of consumers by this system than they do by the ordinary method.

There is much to be said outside the particular form of meter employed to register the gas paid for by the consumer; and I hope the outcome of the discussion will be the introduction and establishment of some more equitable way of charging for gas burned by prepayment consumers than the present rough, ready, and not just system of adding an arbitrary sum to every 100 cubic feet of gas—although I am primarily responsible for it. Indeed, this rough-and-ready mode should be superseded as early as possible by a more equitable plan. Whatever the ultimate outcome is of the use of coin meters to determine the charge to be made to consumers under the prepayment system, the shareholders of all the companies who have relied for business on slot machines are at the present time the victims of a craze. The novelty being gone, the public demand some more businesslike arrangement.

WILLIAM A. VALON.

Temple Chambers, Temple Avenue, E.C., April 22, 1904.

SIR,—I have read with considerable interest the recent statements in the "JOURNAL" as to the stop meters at Croydon, and their alleged advantages over the slot system—based mainly on the injustice to large consumers under the latter method, owing to an additional charge per 1000 cubic feet of gas.

I take this opportunity to point out that the difficulty is surmounted in a very simple way by the Dover Gas Company, who adopted my suggestion to return the surplus at the end of every quarter, after deducting the ordinary net price of gas consumed and rental of meter and stove, in all cases where such quarterly surplus amounted to 5s. or upwards. By this method, slot consumers of (say) 10,000 cubic feet and upwards per quarter, obtain their supply on exactly the same terms as ordinary consumers, with the advantage of easy payments.

The system has worked extremely well, and has given great satisfaction, during the seven years that slot meters have been instituted at Dover; and I am convinced that its introduction elsewhere would be hailed with pleasure by both companies and consumers.

G. H. BUCKMAN, Collector.

Gas Office, Dover, April 20.

Gas Workers and the Workmen's Compensation Act.

SIR,—Your interesting and instructive article on the Workmen's Compensation Act, in which gas undertakings are advised to be their own insurers, induces me to say there is even a more excellent way. This is a way whereby the co-operation of the workmen is secured to prevent accidents—viz., by a mutual fund—which is not only the most effective, but also the least costly plan.

This entails what the Trade Unionists call "contracting out" of the Act. But it is really "contracting in;" for it gives all that the Act requires and considerably more—namely, a higher scale of allowance and payment for the first fortnight, with a pension of not less than 10s. a week to widows for life or widowhood. The weekly allowance is 18s. (or rather more than half average wages) from the first, for all accidents that incapacitate for more than a fortnight; and 12s. a week (or rather more than one-third wages) for those that incapacitate for not more than a fortnight. This is done by a subscription of 2d. a month by each man and 4d. a month for each man by the Company. That is to say, 6s. a year provides all the above with medical attendance per man; and as the wages average rather over £80 a year, it amounts to 7s. 6d. per £100 of wages, of which the men contribute 2s. 6d., leaving only 5s. per cent. on wages as the charge on the Company, against the 10s. per cent. of the Insurance Companies.

There are a good many accidents, as for even a bruised finger that incapacitates for three days, payment for the three days is made; and seeing that the men subscribe to the fund, they have a perfect right to claim on it for every accident. The minor accidents, causing not more than a fortnight's incapacity, have for the last five years averaged 49 per cent. of the total number, and about 44 per cent. of the payments. But the best of it is the sum total of accidents has steadily declined in the five years from 6·9 to 4·6 per cent. per annum, or a drop of one-third.

This happy result I attribute to the active and intelligent co-operation of the workmen, fostered by our system of juries. Every accident that causes a claim on the fund is investigated by a jury of twelve workmen, with the engineer of the station as president; and this not only brings out the cause of the accident and practical suggestions to prevent a recurrence, but it brings home to the workmen a sense of their responsibility, and tends, I believe, greatly to the prevention of accidents. The juries have worked most satisfactorily, and so has the whole system, both to employers and employed.

The scheme was registered under the Act for five years, which term expired last year; and on its renewal for another five years, there was absolute unanimity on the part of the workmen—not a single suggestion of an alteration of the rules submitted to them by our Co-Partnership Committee or a single objector.

This applies to the South Metropolitan Company; but an identical scheme works equally well with the Crystal Palace District Gas Company. I shall be glad to send a copy of the new rules to anyone who desires to adopt the system.

GEORGE LIVESEY.

April 23, 1904.

"Jager" v. "Standard" Purifier-Grids.

SIR,—Without wishing to trespass on your space, we trust you will afford us, as manufacturers of the "Standard" grids, the opportunity of stating that the arches (concerning which Messrs. Cutler and Sons appear to be in so much doubt) are certainly formed, as evidenced by the working model in our office. We might also remark that, as orders for over 115 installations have been received in Germany, one would suppose that the claims of the inventors held good.

With reference to the installation at the Gitschinerstrasse works, we wish to state that, owing to delay in fitting the grids, it is premature at present to quote the results, but we are informed that within a few weeks we shall be provided with the same.

April 25, 1904. SIDNEY HERSEY, Managing-Director.

P.S.—We are sending this letter in Mr. Marshall's absence on the Continent. This explanation should be made, as possibly we have not dealt so fully with the matter as Mr. Marshall would have done.

Manufacturers and the Earl's Court Exhibition.

SIR,—In the event of there being a gas exhibition this year, I think it only fair that the exhibitors should have equal representation on the Council and Committees as the engineers and managers of the gas-works.

The exhibitors provide the working capital, and are, in the majority of cases, practical men, besides which there are experienced men among them who thoroughly understand exhibition work and the organization of the same. A combination of the description suggested would give a more healthy glow to the whole scheme.

April 23, 1904. EXHIBITOR.

The Advantages of Affiliation.

In a letter received from the President of the Eastern Counties Gas Association (Mr. J. H. Troughton, of Newmarket), he makes some remarks on the subject of the advantages of affiliation. The letter was not sent for publication; but the portion referring to this matter contains some useful suggestions, and therefore we publish it.

Mr. Troughton writes: "Perhaps it may seem to some that there are no special advantages to accrue from affiliation; and I am bound to confess that there are none specified. But there are many which will undoubtedly be derived from a closer union with the Institution, representing as it does the whole nation; and, if unity is strength, and there is strength in numbers, then that is an advantage. As to whether the chief advantage will accrue to the District Associations or to the Institution, I think the advantages will be mutual, though there are moral and intellectual advantages which should count for something; and, in addition, there are prospective advantages which a greater unity will bring about. Probably the work of the Gas Companies' Protection Association will be taken up by the Institution, and such matters be dealt with as the Bermondsey clause, municipal trading, railway rates, gas coke for malting, the getting together of facts and figures for parliamentary and other purposes, or even Budget proposals; for it has been suggested recently that the Chancellor of the Exchequer might put a tax on mineral oil used for gas-making purposes. Another matter which could be done to the benefit of the whole industry would be to found and build up a statistical bureau for filing and compiling figures and other information, so that any member might write for, and obtain, such information from headquarters relating to any subject which might crop up, and so do away with the inquiry circular."

The Decimal System.

Referring to the letter on this subject by "One Who Has Tried Both," which appeared in the "JOURNAL" for the 12th ult., and our criticism of it, Mr. Alfred J. Martin, of Chelmsford (who has compiled some "Up-to-Date Tables of Imperial, Metric, Indian, and Colonial Weights and Measures, with Simple Suggestions for Metric Adoption, Imperial Decimal Coinage, &c."), writes to say that, though he is an ardent advocate of the metric system, it appears to him that the gas industry should be excluded from the operations of any compulsory Metric System Bill until decimal coinage is introduced. His reason for entertaining this view is that the combined effect of decimalizing our measures and coinage would probably simplify the adjustment.

Quick Connections.

The notice of the solderless connections of Messrs. George Newton, Limited, in last week's issue has brought communications from the Gas-Meter Company, Limited, and Messrs. George Orme and Co. The printed particulars sent by the former show George's patent union joint for both gas and water fittings, and by the latter Orme's union joint for connecting lead pipes without the use of solder.

The Gas-Meter Company in their letter say: "We notice in your issue of the 19th inst., p. 153, an illustration and description of 'Newton's Solderless Main Tap.' We refer to this for the purpose of informing your readers that the idea is not new, as some eighteen years ago we took out patents for a joint in many respects similar to that described. As you will see by the enclosed lithos, the only apparent difference is that 'Newtons' have no linings, whereas ours have. This, we think, is preferable, as it can be used for both gas and water; and the greater the pressure that is put on, the tighter the joints become. We may state that we have supplied these largely to both gas and water companies with very satisfactory results."

Messrs. George Orme and Co. write: "Referring to the article in your issue of the 19th inst. *re* 'Quick Connections,' permit us to say that we are the original patentees of this solderless connection, and have been making them for some years. They are illustrated in our catalogue."

PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOMS.

WEEK by week confirmation accrues of the prediction that the session would mark a record for rapidity in the matter of gas and water work in Committee. There is an occasional burst of life—such as in the cases of the Doncaster, Barnet, and the Cheshire Bills—and then all is flat again. The Bills mentioned are really the only ones worth touching upon this week, as the first two were also the only ones deserving special notice last week. The fresh developments in connection with the Doncaster Bill are referred to below. It will be seen that the Barnet Company have been victorious with their Water Bill; but Parliament has refused to entertain the Cheshire Power Gas and Electricity project. The Cyrstal Palace District Gas Bill, shorn of its distinguished features under the circumstances stated last week, has now been removed from the opposed list; all the petitioners against it having withdrawn.

Doncaster Gas. The consideration of clauses in connection with the Doncaster Corporation Bill brought about a few changes in the general position of the gas section as left in last week's notes. It was then mentioned that the Local Government Board did not appreciate the proposed extension to prepayment consumers of the model clause under which consumers of gas are to give twenty-four hours' notice to the Corporation before quitting their premises; and a doubt then existed as to whether, when clauses were discussed, the Committee would allow the retention of the extending words. In default of notice (which might be rather common in the case of prepayment consumers), the clause imposed on them the liability "to pay to the Corporation the money shown by the meter to be due on the next subsequent occasion on which such meter may be examined by the Corporation." The number of thefts from meters in empty houses, and the few convictions they have obtained, suggested to the Corporation advisers the desirability of obtaining this explicit right to recovery from the previous tenants. While we are averse to saddling too much responsibility upon a class of consumers whose consumption of gas is paid for in advance, no impregnable argument can be made against the contention that some means should be given by which notice of removal can always be insisted upon. And without there is some responsibility attached to the failure to do for the gas suppliers what a tenant is bound to do in the case of his landlord, it is difficult to see how the notice can be made compulsory. The Committee were not unanimous on the point; but the majority were against the extension of the model clause. The Chairman was not called upon to say that there was not unanimity on the Committee; and so it was good of him to show that the evidence in favour of the specific inclusion of prepayment consumers in the clause had had some effect. The only other change from last week's review of the position of the gas section of the Bill was effected by the striking out of the power-gas clause.

Barnet Water. Three days more last week were spent by the Barnet Gas and Water Company in their courageous fight against the strong pressure on all sides of the powerful objectors to their obtaining increased water resources, of which, it is patent to all disinterested observers, and is admitted to be so even by their opponents, they stand in present need. Listening to the opposition, one might almost have been persuaded into believing that they knew more about the Company's business than the Company knew themselves; and they gave out with ready tongue impressions that the Company could do better in respect of obtaining more water by going elsewhere than to the Little Berkhampstead site. But there was the evidence of the eminent authorities on the subject the previous week to repress any doubt which the new evidence might otherwise have encouraged. The suggestion was frequently dinned into the ears of the Committee that the Company could get all the water they required from the Metropolitan Water Board. But no one among the opponents had consulted the Board as to whether they would be prepared to give a supply; nor had Counsel appearing for the Board any instructions from them to say what they were willing or able to do in this respect. Counsel, however, did say that the Chairman of the Board and the Chairman of the Works Committee were "prepared to recommend" the Board to give the Barnet Company a supply on reasonable terms. But the Chairmen do not happen to be the Board; and it is too much to ask a Parliamentary Committee to throw out a Bill on such a nebulous condition. The Company, too, had a preference for sinking their own well, and providing themselves with what they required; and no doubt they have very good reasons for this. In the capital powers sought, there was a sum of £52,000 earmarked for a well, too, at North Minns. But there was uncertainty as to the yield of a well in that locality; and so the Company stated their willingness to have this particular clause cut out. This deletion formed a provision in the decision of the Committee, which declared the preamble of the Bill proved. The representatives of the Company present were highly elated over their success in face of the remarkable strength in numbers and position of their opponents. But there is the cost of this contest of might against right; and it is regrettable that the heaviest weight will fall on the Company, who are least able to bear it. The opponents, however, will also have decent accounts to foot, which will keep green for a bit the remembrance of the sturdy fight made by the Barnet Company. The decision once more marks the resolve of Parliament that geographical boundaries shall not limit them in awarding powers of taking water where it is proved that water is required. There was another sitting of the Committee on Friday (the decision having been delivered on Tuesday) for the consideration of clauses. The Herts County Council and the Metropolitan Water Board did not appear, and so the prospect is that there will be another fight in the Lords. The electrolysis clause which the promoters had included in the Bill was discussed; and this gave the opportunity for Mr. J. G. Newbigging to produce his "ghastly" specimens of the inefficiency of the Board of Trade electrical tramway regulations in the case of Manchester. In this city the Electricity Department acknowledge the damage by

paying for it every time a gas or water pipe is shown to be affected. The Committee, however, could not be moved to sympathize with the Barnet Company's appeal for protection; and the clause was taken from the Bill.

Cheshire Power Bill Rejected. Either the promoters of gas and electrical power schemes are getting disheartened, or else the public are losing patience over unfulfilled promises. It may be both. In previous sessions when the big Mond gas and electrical schemes were before the Committees, there was not a room among those that are ordinarily occupied for Select Committee work, that could comfortably accommodate the crowd of professionals and other persons appearing either as supporters or opponents, and those who were drawn thither by interest of other kind or simple curiosity. Yesterday week, and during the succeeding days until Thursday, the numbers who assembled in the room in which Mr. Cawley's Committee were sitting, to take part in or hear the proceedings on the Cheshire Electricity and Power Gas Bill, were comparatively few. The promoters had not been so lavish as in previous sessions in the matter of Counsel (two sufficed) and witnesses; and, although the aim of the promoters was to take unto themselves a portion of the country measuring some 1023 square miles in which to supply Mond gas and electricity, the Local Authorities who were opposing were also few. There were some three or four Authorities who own gas and electricity works among them; but, as a matter of fact, as any fear which gas suppliers may have had on the score of the competition of Mond gas is diminishing, that of the owners of municipal electricity works appears to be increasing. Throughout, the electrical opposition to the scheme was predominant. This Cheshire Bill is—or rather (we must now speak of it in the past tense) was—the resuscitated portion carved out of the North-Western scheme by Parliament last year; and it was now brought up as an independent project with a capital of a million and one-third borrowing powers. The story that has been so often told of the boon that Mond gas and electricity generated by its aid would be to the district served, and of how it would benefit and develop industries, was repeated; but the weakness in the case was that the promoters were unable yet to produce any evidence to show that their forecasts in these respects have been borne out by experience—they could produce no manufacturers yet to tell of the boon and development enjoyed as the result of the conferring by Parliament upon the South Staffordshire Company of very extraordinary powers. There is no need to trace here the evidence; it was merely the old pressed into service again, with much of the strong backing missing that was so readily forthcoming when such schemes were new, and when it was believed that there was money to be made out of them. The Committee did not care to hear the opposition. After four days on the promoters' case, they had a little consultation, and settled the Bill by declaring that the preamble was not proved. This may be taken as a hint that what Parliament want now is some proof that the promises on which the South Staffordshire and North-Western schemes were granted are being realized, before allowing further extensive tracts of the country to be exploited in the same manner.

Water Bills in the Lords. There were two Lords Committees sitting at the end of the week—this being the first appearance of the Lords since the Easter recess. One Committee, under the chairmanship of the Earl of Lauderdale, quickly cleared themselves of the Derwent Water Board's Bill, which has for its object certain alterations of works, and the better and more economical distribution of the water. For this purpose, the course of various aqueducts is to be changed, and powers are taken to construct certain roads. Provision is also made in respect of the necessary borrowing powers. Only the Duke of Norfolk opposed—he, as the owner of the Derwent Hall Estate, insisting, under the protective clause granted to him in 1899 and 1901, upon the promoters making the works then provided for as a private road for him, while the Board asked to be permitted to abandon that part of the road. The Committee would not hear of his Grace's rights being interfered with. Another Committee, presided over by the Earl of Camperdown, considered the Bill of the Ebbw Vale District Council, by which they are making provision for the construction of new water-works for the district (the principal feature of which is a large reservoir), at a cost of £115,000. There were several opponents partly on the question of compensation water, and partly against any interference by the promoters with the Ebbw, which interference it was believed would be detrimental to their interests. How far they succeeded in making out their case is shown by the fact that the Committee were of opinion that the preamble of the Bill was proved. A third measure connected with water was that by which the Harrogate Corporation sought authority to construct a tramroad in connection with the water reservoir sanctioned in 1901. Over this tramroad Leeds obtained running powers for communication with the reservoir they were authorized in the same session to build at Leighton. Something has happened which has brought both Corporations to Parliament this year to get permission to each construct a new line; so that over this matter the Corporations are now in competition. Harrogate has arranged with the landowner to use a 2-feet gauge line; Leeds proposes a 4 ft. 8½ in. gauge. Harrogate's proposal is supported by the landowner; while that of Leeds has been petitioned against by him. Harrogate express their readiness to carry the whole of material required for the Leeds reservoir. The statement of the position by Mr. Balfour Browne, K.C., was all that the Earl of Camperdown and his noble colleagues heard before rising on Friday; and yesterday morning witnesses were called.

Discount for Gas Consumers at Belfast.—The Belfast Gas and Electricity Committee have unanimously agreed that the Council be recommended to sanction the following scale of discounts to all gas consumers, to take effect from the 1st inst.: On a quarterly consumption not exceeding 50,000 cubic feet, a discount of 5 per cent., provided that the accounts be paid on or before Jan. 27, April 27, July 27, and Oct. 27, in each year. It is said the granting of this discount will mean a reduction of over £2000 in the income of the Gas Department.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Brixham Gas Bill, Colney Hatch Gas Bill, Southend-on-Sea Gas Bill.

Bills read a second time: Bexhill Water and Gas Bill, Gomersa Gas Bill, South Shields Gas Bill.

Bills read the third time and passed: Barnard Castle Gas Bill, Barrow-in-Furness Corporation Bill.

The Select Committee on the Belfast and North-East Ireland Electricity and Power Gas Bill reported that they had not proceeded with the consideration of the Bill, the opposition thereto having been withdrawn.

The Newcastle and Gateshead Water Bill and the Oakengates, Dawley, and District Joint Water Board Bill have been referred to a Select Committee, consisting of Lord Clifford of Chudleigh (Chairman), the Duke of Manchester, Lord Zouch of Haryngworth, Lord Ravensworth, and Lord Rosmead; to meet next Thursday.

Petitions have been presented against the Chippenham Gas Bill and the Sheppey Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Barnard Castle Gas Bill, Barrow-in-Furness Corporation Bill.

Lords Bills read a second time: Gosport Water Bill, Harlow and Sawbridgeworth Gas Bill, Huddersfield Corporation Act, 1902 (Amendment), Bill, Matlock and District Gas Bill, New River Company Bill, Yorktown and Blackwater Gas Bill.

Bills reported: Barnet District Gas and Water Bill, Cheshire Electricity and Power Gas Bill [Preamble not proved], Tynemouth Gas Bill [Lords].

Bill read the third time and passed: Amersham, Beaconsfield, and District Water Bill.

The petitions presented against the Crystal Palace District Gas Bill by the Corporation of Croydon and the Camberwell Borough Council have been withdrawn.

POLICE AND SANITARY COMMITTEE.—Monday, April 18.

DONCASTER CORPORATION BILL.

The Committee having disposed of the electrical clauses and certain general provisions of the measure, reverted to Part III., relating to water-works.

The Chairman asked the representative of the Local Government Board—Mr. Boyce—whether the department objected to the period of seven years being allowed for the construction of water-works.

Mr. Boyce replied in the negative.

The Town Clerk of Doncaster gave evidence on the point.

The period of seven years named in the Bill was then agreed to. It was also decided that the water supply from the present reservoirs should be given at not less than the existing levels.

The Gas Clauses.

The Committee then reverted to the part of the Bill dealing with the gas undertaking.

The Bill contained the following clause:—

40.—Twenty-four hours' notice in writing shall be given to the Corporation by every gas consumer before he shall quit any premises supplied with gas by meter (whether an ordinary meter or a prepayment meter) by the Corporation, and in default of such notice the consumer so quitting, if supplied by an ordinary meter, shall be liable to pay to the Corporation the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises or the date from which any subsequent occupier of such premises shall require the Corporation to supply gas to such premises, whichever shall first occur, and if supplied by a prepayment meter, shall be liable to pay to the Corporation the money shown by the meter to be due on the next subsequent occasion on which such meter may be examined by the Corporation. Notice of the effect of this enactment shall be endorsed upon every demand note for gas rent payable to the Corporation.

Mr. *Robert Watson*, the Gas Engineer to the Corporation, who was recalled, gave evidence as to the desirability of the insertion of the clause in the Bill. He said the proposal was an extension of the model clause. The model clause was as follows: "Twenty-four hours' notice in writing shall be given to the corporation by every gas consumer before he shall quit any premises supplied with gas by meter by the corporation, and in default of such notice the consumer so quitting shall be liable to pay to the corporation the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises shall require the corporation to supply gas to such premises, whichever shall first occur. Notice of the effect of this enactment shall be endorsed upon every demand note for gas-rent payable to the corporation." Witness pointed out that this model clause applied to ordinary meters. Clause 40 of the Bill proposed to extend it to slot-meters. It was found in practice that where tenants left their houses, persons who were sometimes on the wait for this purpose went in and broke open the money-boxes, and abstracted the contents. If it were necessary for notice to be given, this sort of thing would be prevented.

The Chairman: What you complain of is that people break into the empty houses and steal, not your gas, but the money which has been paid for it.

Witness: That is so.

The register would show the amount of money paid and the quantity of gas consumed by the outgoing tenant. No one would be able to interfere with the apparent amount of gas supplied?—No, that would be practically impossible. The difference between the amount of gas used, as shown by the register, and the money in the box is owing to the breaking open of the box and the robbery of the contents.

How often do you examine the boxes?—Once a quarter. The consumption is small.

What is the amount of money you get in the boxes?—From 2s. or 3s. up to 20s., and as much as 30s. or 40s. The meters are different sizes. If the amount of gas used is large, we have 1s. slot meters. We hear of people watching houses that are being vacated in order to enter and rob the boxes.

Mr. PAGE: Of forty thefts, we have had only nine convictions.

In reply to Mr. J. W. WILSON (a member of the Committee), witness said they had not tried the deposit system with the slot-meter consumers. The Corporation had two collectors, who were continually going round examining the slot meters. They cleared thirty or forty boxes a day.

Mr. WILSON: You might pay to the consumer who was vacating his house a fee for acquainting you with the fact.

Witness was understood to say that this would impose a serious burden on the Corporation.

The CHAIRMAN said the majority of the Committee were against going outside the model clause, which was applicable only to meters that were not prepayment. They were not unanimous on the point; but the majority were against exceeding the present liability. Clause 40 would be brought back to the form of the model section.

Mr. VESEY KNOX drew attention to a clause in the filled-up Bill (27 B) which, he said, would impose on the outside districts a limit of five years for the exercise of the option to purchase the parts of the gas undertaking in their area. He maintained that it was not reasonable that the Corporation of Doncaster should go on building up a valuable business and be liable in the future at any time to be bought out for merely the value of the plant, having nothing for goodwill. As to precedents in cases of non-statutory companies, the period for purchase was usually twelve months after the passing of the Bill; the limit being five years. He thought that five years would be fair in the case of a corporation. A longer period than this would be open to great objection. Within the next five years there might be a great change in the district, in the development of the coal-fields and so forth. It was not desirable, from an economic point of view, that Doncaster should be compelled to carry on this undertaking for an indefinite period on the understanding that it might be broken up at any time on payment of plant value only.

Mr. COWARD, for Balby-with-Hexthorpe, objected to anything in the nature of a time-limit, declaring that the effect of such a thing would be taking away with one hand that which was given with the other. No time-limit had been imposed in the case of the water clause.

Mr. TALBOT, for Wheatley, endorsed the observations of Mr. Coward. He pointed out that a clause had been submitted to the Local Government Board in the form in which his clients desired to have it. The period the promoters would fix would expire at a time when it would be impossible for his clients to begin upon the undertaking. The case of a non-statutory company was an entirely false analogy.

The Committee decided that no time clause should be inserted in relation to the purchase of the gas undertaking. They had tried to frame a fair check on the extravagance of the Corporation in taking money to themselves at the expense of the outside districts, and they had meant this check to operate for all time, and balance things fairly between the two parties.

Mr. COWARD: The language you propose will be: "At any time after the passing of this Act."

The CHAIRMAN: Yes.

Mr. COWARD said his clients took exception to clause 45, which dealt with power gas. It was as follows:—

45—(1) The Corporation may manufacture, sell, and supply within the gas limits for purposes other than illumination any other substitute for coal gas, and may adopt any patent or other kind of gas in substitution for, or to supplement, coal gas at present supplied by the Corporation, and supply the same for motive or other power, heating, or for any other purpose to which such gas or patent can be applied. Provided that it shall not be lawful for the Corporation at any time to supply gas that contains more than 14 per cent. of carbon monoxide, or which does not possess a distinctive and readily perceptible smell.

(2) For any contravention of this section by the Corporation, the Corporation shall be liable, on summary conviction, to a fine not exceeding fifty pounds.

He would ask that this clause be struck out. No evidence had been given as to its necessity, or that it would be at all in the public interest. No customers had been suggested; and he ventured to think that it would be a most unusual course for the Committee to pass such a clause. The objection had been raised in paragraph 19 of the petition of Balby.

Mr. TALBOT supported the observations of his learned friend.

Mr. *Watson*, recalled, said that the power now sought had been given in the Buxton Bill in 1902; and he was informed that it had also been given in a number of other cases. He thought it desirable that the Doncaster Corporation should have the clause. It was possible there might be a commercial future for a non-illuminating gas. The Mond Gas Company were at work in South Staffordshire, and the Doncaster Corporation were watching their operations. The Corporation would not spend money in this direction until they saw that the Mond gas scheme was a success.

In cross-examination by Mr. COWARD, witness said they had had no applications for this gas as yet; but the Corporation themselves had considered whether it would not be desirable to have an installation of gas-engines instead of steam-engines at their sewage works. No doubt separate mains would be required for power gas.

Mr. COWARD: But this clause would give you a roving commission, and enable you to adopt anything you liked in substitution for gas?

Witness: Yes; but we only propose that which has been given to Buxton and Caterham.

The CHAIRMAN said the Committee were against giving powers of this sort.

Mr. PAGE asked that the Corporation might have the clause in Doncaster itself.

The CHAIRMAN: No; the case for it must be placed before us in a much fuller way before we allow the clause. It cannot be done by a single line in an Improvement Bill. We consider that the application is premature.

Mr. TALBOT applied for a clause declaring that there should be gas-testing places in Balby and Wheatley—testing places other than at the works.

Mr. PAGE resisted the application.

The Committee refused the proposed clause.

After some discussion, the period for the repayment of the loan as to gas was fixed at thirty years, and the period for the repayment of the debt as to water at sixty years.

The Committee sanctioned the financial clauses, which included £45,000 for water-works and £40,000 for gas-works.

The Committee adjourned, it being understood that the clauses, amended by their decisions, would be formally brought up later in the week.

HOUSE OF COMMONS COMMITTEE.

Monday, April 18.

(*Before Mr.* CAWLEY, *Chairman, Col.* DENNY, *Dr.* HUTCHINSON, *and Mr.* REMNANT.)

CHESHIRE ELECTRICITY AND POWER GAS BILL.

This was a Bill to incorporate and confer powers upon the Cheshire Electricity and Power Company, with the object of supplying electricity and power gas.

Mr. SHIRESS WILL, K.C., and Mr. GREIG appeared for the promoters. Other Counsel were engaged as follows: Crewe Corporation, Mr. HONORATUS LLOYD, K.C., and Mr. R. B. BANKES; Altrincham Electricity Supply Company, Lord R. CECIL, K.C.; Stockport Corporation, Mr. HONORATUS LLOYD, K.C., and Mr. G. RHODES; Mr. H. Pratt, Mr. C. C. HUTCHINSON; the Stalybridge, Hyde, Moseley, and Dukinfield Tramways and Electricity Board, Mr. WEDDERBURN, K.C., and Mr. C. C. HUTCHINSON; the Trustees under the will of the late Earl of Stamford and Warrington, Mr. J. R. C. DILL; the Corporations of Stalybridge, Hyde, and Dukinfield, Mr. RAM, K.C., and Mr. RHODES; and the Altrincham Urban District Council, Mr. HARPER. A number of other authorities presented petitions, but reserved Counsel.

Mr. SHIRESS WILL, in opening, said the proposed area of supply was the county of Chester; and the capital sought was £1,000,000, with the usual borrowing powers as to one-third more. The district was 1023 square miles in area; and it contained one city, three county boroughs, six boroughs, 36 urban districts, and 13 rural districts—a total of 59 local authorities, of whom 49, with a rateable value of £3,359,000, were either supporting the scheme or were neutral, besides which there were a number of petitions in their favour from manufacturers. The districts of fifteen of the local authorities had electricity; the supply in most cases being in the hands of the municipality. All had authority to supply electricity for power purposes; the reason being that every Provisional Order or Act which authorized the supply of electricity for public and private purposes involved the power to supply electricity for power. The Bill was drawn on the ordinary lines. As regarded Mond gas, it followed the Staffordshire Act and the North-Western Electricity and Power Gas Act; and as regarded electricity, it followed the Yorkshire Electric Power Act and other similar Acts. The promoters anticipated a very large demand for power—for electricity for power, and for Mond gas for power. They would be able to generate electricity on a much larger scale than the local authorities or the local companies could; and existing suppliers would be able to buy current from the promoters at a cheaper rate than they could make it, or buy it ready made from them, or, if they chose, they could compete with the promoters. It was not proposed to take a monopoly of any district. With regard to Mond gas, nothing new was proposed. Power was simply sought to cover the area which was excluded from the North-Western Electricity and Power Gas Act of last year. The promoters of the present Bill were quite independent, though they included some of the promoters of that measure. The Bill would introduce into Cheshire the inestimable boon of cheap fuel in place of the expensive fuel which the industries of the county were using at present. There were some opponents; but none of them could supply the boon of Mond gas as cheap energy. The power of Mond gas lay in its heating capacity. The cheapest way of producing electricity was by means of dynamos driven by gas-engines worked by Mond gas. As regarded the opponents who were supplying power, their opposition really amounted to a fear that cheap power would be introduced and hurt their dear power. But these opponents could not expect to stand before Parliament on any higher ground than anyone else who invested in a work for supplying power; and therefore they ought not to prevent the wants of trade, especially cheap power, being supplied.

Mr. *John Sturgeon* said he had devoted special attention to the subject of power distribution from central stations. He was promoting Engineer of the North-Western scheme of last session. The area proposed to be served by the present Bill formed part of that scheme, but was struck out on the ground that the area asked for was too large for the capital sought by the Bill. The development of the gas-engine in recent years, and its economical advantages over the steam-engine, had been shown to be so great that the development of gas with electricity must be of considerable service. They could obtain power by means of a gas-engine working with Mond gas at about one-fourth of the cost of power under the best possible conditions with steam, using Welsh coal. The object of the present scheme was to obtain authority to distribute from central stations not only power gas, but

electricity generated by power gas. The industries in the area—such as coal mines, quarries, salt works, &c.—could not employ coal as the most economical force, and, consequently, the driving by separate electrical motors supplied by electricity, or engines driven by cheap gas, would prove of the greatest economical advantage.

In cross-examination by Lord R. CECIL, witness said he could not think of a considerable manufactory in the Altrincham and Ashton-on-Mersey district that was going to take power from the promoters. This, however, did not matter; when the power was there, manufacturers would come quick enough. They had had an example of this at Niagara. When witness first went there, in connection with a system of power conversion and distribution from Niagara Falls, it was a howling wilderness; now it was a busy manufacturing centre. The Bill did not contemplate giving a supply for lighting, except that a manufacturer who took electricity for power could use up to 30 per cent. from the same main for lighting. It would be very hard upon manufacturers to have to go to the expense of laying a main for lighting when they had one already for power purposes. Power gas could only be made suitable for lighting by enrichment. A provision of the Bill directed that no power gas should be used for lighting purposes.

Tuesday, April 19.

Mr. SHIRESS WILL informed the Committee that Birkenhead allowed the promoters to go into that part of the Mersey docks and harbour works which lay on their side; Birkenhead being otherwise excluded.

Mr. *H. A. Humphrey*, examined by Mr. GREIG, said he had had 14 years' experience of the manufacture and application of Mond gas, and had seen it applied to a very large number of purposes, with most successful results in all cases. He had himself carried out experiments in the application of the gas for the production of power—experiments commenced in 1894—with the result that the gas had since been used on a very large scale for this purpose. There were now about 35,000 horse power of gas-engines driven by Mond gas. The area proposed to be taken was a portion of the North-Western scheme of last year. There were no engineering difficulties which could not be readily met. He had seen the principal sites, and he knew the district very well. As to the progress the South Staffordshire Company had made in the erection of their works; their first generating station was now nearly complete. They had overcome the difficulties which had been met in many cases more rapidly than they could have anticipated. Gas distribution under high pressure had been commercially attempted in America on a large scale. He had gone there to study the question of the distribution of natural gas under very much higher pressures, and over very much longer distances, than anything proposed in the present Bill. The pressure in America ranged up to 250 lbs. per square inch, and even more close to the wells. Under the Bill, they proposed to use steel mains with special joints, and pipes tested up to a pressure of 300 lbs. per square inch. They had already made some of these mains in South Staffordshire. In the process of manufacture, the idea was to use common slack gasified, and to recover the sulphate of ammonia as a residual product. He was of opinion that the capital set aside was sufficient for the purpose of making a satisfactory start. He believed this gas, coupled with electricity, would lead to great economy in the running of engines. A profit of 4s. per ton of coal was made out of the ammonia. Asked if there were many Mond gas plants in existence, witness said there were over 40, either actually at work or in process of construction, with a united capacity of something like 344 million cubic feet of gas per day—an amount representing in a two days' make as much as any one of these opposing gas companies would manufacture in the whole year. The demand for a cheap supply of fuel gas was increasing daily. Manufacturers were discovering that the use of the gas meant better and cheaper work; and they were finding out that it could be applied to a great many more industrial purposes. They were fostering the rolling mill industry by this gas, for instance. The bulk of the gas in South Staffordshire would be utilized for heating purposes in furnaces—principally of the regenerative type. Mond gas was not only a cheaper fuel, but cleaner and better for enamel work and japanning. Witness proceeded to give details as to the plant proposed at Stalybridge and Stockport. He said that with a 15-inch main about 5000-horse power could be supplied. The gas had 150 British thermal units per cubic foot. There were no deposits from the gas in the mains. It had no heavy hydrocarbons, and there was no nuisance created. Mond gas was poor, but remarkably cheap. It had only about a fourth of the power of illuminating gas; but it could be sold at 2d. per 1000 cubic feet. To compete with it, ordinary illuminating gas would have to be sold at 8d., or slightly more than 8d., per 1000 cubic feet. The usual price of coal gas was three times this amount.

Mr. GREIG: What does the cost of the gas work out to?

Witness: Less than one-third of the fuel cost for the principal electric light undertakings in this country.

In reply to the CHAIRMAN, witness said that by the use of Mond gas they could drive at from $\frac{1}{10}$d. to $\frac{1}{8}$d. with gas sold at 2d. per 1000 cubic feet. They proposed to charge 2d. per 1000 cubic feet for the gas; but their maximum charges would be 3d. and 4d. The cost of the gas in the smallest engines would be less than $\frac{1}{2}$d. per indicated horse power per hour.

The CHAIRMAN: Would it be cheaper to produce electricity at your generating station close by your gas plant and take it five miles, or to take the gas five miles and generate electricity at the end?

Witness: If you want big units and large power, I should say take the gas. It would be cheaper to a customer to take gas than to take electricity.

By Mr. GREIG: This gas was not intended, nor was it suitable, for lighting purposes. A clause in the Bill would prevent it being sold for this purpose. It is of no use for incandescent mantles. Messrs. Brunner, Mond, and Co. were supplying the Northwich Electric Supply Company with gas for generating electricity for the purpose of public supply at 2d. per 1000 cubic feet.

Cross-examined by Mr. RAM, for the Corporations of Stalybridge, Dukinfield, and Hyde. These Corporations (except Dukinfield, which was not in the measure) were struck out of last year's Bill. These areas were not required as a means of access to other places. He was aware that the three districts had formed themselves into a Joint Board for the supply of electricity, with an authorized capital (with borrowing powers) running up to £500,000. They were spending £127,000 on their plant. He regarded the Joint Board as the best possible customer; but other customers, no doubt, would take power gas or electricity from the promoters if they could get it cheaper than from the Joint Board. This might damage the latter body. All the consumers in the district would be ratepayers.

Mr. RAM: If the ratepayers get electricity cheaper from you than from the Joint Board, they will have to make up the loss to the Joint Board as ratepayers?

Witness: That involves a great error. If they have surplus plant and can supply all the surplus power A, B, or C may take from you, your position would be true; but they have not the surplus plant.

You would not come into this district unless you thought you could get customers?—Certainly not.

Witness went on to say that the Mond gas was a very promising thing, but as yet it had done nothing except promise. It had not had sufficient opportunity. It might be that the South Staffordshire £10 shares, on which £6 had been paid, were quoted on the 11th of the present month at £8 to £6 discount, and that, at the last transaction, the seller had to give the buyer £1 a share to take them off his hands. The Company hoped to be at work by the end of the summer.

Witness put in the estimate of capital cost showing the following figures:—

Mond gas plant		£42,555
Ammonia and recovery plant		6,250
Boilers, gas compressors, and electric light plant		16,365
Land, foundations, and buildings, and sidings, &c.		22,580
Gas distribution systems		61,050
		£148,800
Contingencies		14,880
Total for one large station		£163,680
Total for three large stations	£491,040	
Total for three smaller stations	250,000	
Total for all six		£741,040
Each smaller gas-station costs for the whole gas plant of four producers and all corresponding ammonia recovery plant, &c., with land and buildings complete		44,000
Distribution mains, meters, &c.		39,000
Total for one gas (only) station		£83,000
Total for three gas (only) stations (say)	£250,000	£249,000

In cross-examination by Mr. WEDDERBURN, witness denied that the Committee last year had thrown out every part of the Bill except what was unopposed. The Committee took away this part of the measure because they considered the capital was not sufficient. The position as regarded capital, *qua* capital, this year was the same as last.

Wednesday, April 20.

In further cross-examination by Mr. WEDDERBURN, witness said by clause 30 the promoters could purchase certain electrical undertakings in the proposed area. The estimates approximately balanced the capital powers sought in the Bill; and if they carried out the purchase of other undertakings, the expenditure by the promoters upon their works would be reduced. There was no allowance in the estimates for engineering working capital; but very little such capital would be needed. For the three gas stations which it was proposed to construct at first, he should allow as working capital £15,000 or £20,000. Counsel put it that for the purchase of the Northwich electric undertaking (which was not covered by the estimates) something over £25,000 (probably £40,000) would be required; and witness did not seriously dispute the figure. The maximum sum payable for interest during construction (which also was not covered by the estimates) was £40,000; and, small or large, this money would have to come out of working capital. Witness admitted also that there had been no allowance made for "contingencies" in respect of the smaller stations; and it was suggested that for this £25,000 should be set apart. Counsel was proceeding to examine witness with regard to some other details of the estimates, when

The CHAIRMAN interposed with the remark that he would prefer that such details should not be gone into at present.

Mr. WEDDERBURN said he was preparing to show that, upon the estimates, the works would be insufficient; that the mains radiating from the station as proposed would supply only 678 square miles, whereas the area was over 1100 square miles.

Witness said he was prepared to meet this point.

Cross-examined by Mr. LLOYD: The Bill could not create a monopoly in the supply of Mond gas in this district. It would not confer any more exclusive right on the Company than was conferred by the other Bills.

The CHAIRMAN said the Committee would like to know in what state already authorized power-gas concerns were.

Witness said that one station in South Staffordshire was nearly completed, the machinery having been installed; but no gas had been supplied yet. In the case of the North-Western Company, nothing had yet been done.

Further examined by Mr. LLOYD: No one had ever distributed Mond gas at a greater distance than three-quarters of a mile from the works; they had not needed to do so.

Mr. LLOYD: Am I not right in saying that there is a district or districts in Cheshire to which the Company have given an undertaking that they will not supply power gas?

Witness: Only Chester, so far as I know.

Mr. SHIRESS WILL, answering Mr. Lloyd, said there was no district in the area except Chester which it was intended to except from the supply of power gas.

In re-examination by Mr. GREIG, witness said there was no difficulty in a manufacturer using Mond gas of his own production. This was shown by the large number of Mond gas plants at work at the present time. The South Staffordshire Gas Bill was the first instance in which the distribution of Mond gas on a large scale was submitted to Parliament. The scheme was authorized two years ago; and it was now being carried out. Last year the North-Western Company came with a Mond gas scheme combined with electricity. The scheme was passed with the excision of the district which formed the district of the present Bill. Owing to the fact that Cheshire was excluded from the Act of last year, the North-Western Company found it necessary to re-arrange their generating stations, for which purpose they were promoting a Bill in the present session. It was not therefore to be wondered at that the Company had not proceeded to exercise their powers. So far as regarded such of the stations as it was not proposed to alter by the Bill of the North-Western Company, the plans were in course of preparation. If the promoters of the present Bill introduced competition, and it was successful, it would only be because they could supply at a cheaper rate.

By the CHAIRMAN: He did not think the South Staffordshire Company's shares had ever been at a premium. The value of the shares had steadily declined.

The CHAIRMAN: Do you think, considering that you have to give something with a share of the only existing Company working Mond gas to get it taken off your hands, that there would be the slightest possibility of the public taking up the shares in a new Company established for the purpose of distributing Mond gas?

Witness: I do by the assistance of the manufacturers, because they understand the thing better and know that there is a great future before it.

In further examination by the Chairman, witness said he would not use Mond gas for heating boilers, because they were not regenerative. The largest Mond gas plant actually in operation was at the works of Messrs. Brunner, Mond, and Co. It was equal to some 30 million cubic feet daily. The next largest he should say was at the Armstrong-Whitworth works at Manchester—that plant being equal to supplying 18,000-horse power continuously working.

By Colonel DENNY: There was absolutely no reason why Mond gas should not carry under pressure as far as coal gas; it was more permanent in its nature. He believed that on certain parts of the estimates considerable saving could be effected; and this saving could be set against the items not covered by the estimates.

Mr. *John Emery*, Manager of the Howard Street Mills, Stockport, and a Director of another firm of cotton spinners of Stockport, held the opinion that a supply of power gas and of electricity for power purposes at works of this kind would be an advantage. There would be a market for Mond gas in Stockport if it were only provided at a cheap price.

Mr. *T. H. Jackson*, the Chairman of the Wirral Railway Company, said he was quite prepared to consider the taking of a supply of electricity from the promoters for the purpose of working the railway. It would be a very great benefit to the Birkenhead neighbourhood if Mond gas were obtainable there.

Thursday, April 21.

Mr. *James Fawcus*, examined by Mr. SHIRESS WILL, said he had been connected with the production and distribution of electricity for a long period. During recent years, he had been concerned in the development, among others, of the Lancashire Electric Power Company and the Yorkshire Electric Power Company. He considered that the district proposed to be supplied under the Bill was one of the best not already accommodated There was a good deal of difficulty in every case of power companies in raising capital; but there was no instance in which he had been connected but ultimately sufficient capital for a start had been obtained. With regard to the Yorkshire and Lancashire Companies, they had in each case raised about £500,000, with which to commence their operations. The Lancashire Company's works would, he believed, be in operation this year, and the Yorkshire Company's works would certainly be operative about September. He saw no distinction between raising capital for electric power and for electric power and Mond gas; but he could form no opinion. The present was not a favourable time in the Money Market. The capital would never be found by the public at first. In the Yorkshire case, the promoters themselves subscribed for something like £120,000, and the contractors either underwrote, or took, shares to the amount of £250,000. The balance was raised by debentures. He was also connected with the Trafford Power Company. They had, though not in use yet, a Mond gas plant; and they intended to supply the gas for power. It was wonderful the number of industries taking power from the Company. He was connected with the Altrincham Electric Supply Company. He did not think the Bill would harm that Company, and he should recommend them to support it, for by doing so they would put themselves in a position to earn a dividend much more quickly.

In cross-examination by Lord R. CECIL, witness said he hoped the Altrincham Company had gone through their unproductive days, and were now entering on their productive period. He maintained that the present scheme would not strangle it. He thought it would be a fair thing to put a clause in the Bill to prevent competition with that Company.

Mr. *Ferranti*, examined by Mr. GREIG, said his opinion was that it would be a great advantage to combine, as here proposed, to produce electricity and Mond gas. The experience of the Midland Power Company had been much the same as that of other power companies, with one exception. The public had taken no interest whatever in the undertakings. People, however, interested in the progress of the electrical industry had come forward and found the necessary money. The exception he had spoken of, where the money had been found by the public, was that of the Newcastle Power Company; and the reason was that they had the Borough of Newcastle originally upon which they showed good results. They had now spent about £1,000,000. In North Italy practically none of the cotton mills were driven by steam power, but by electricity derived from the water power there.

By the CHAIRMAN: He thought that the public would ultimately come into these power companies much in the same way as they now did in the case of gas companies. People would presently be falling over each other to put money into them. The present was pioneer work. A great deal of money had already been obtained, and he anticipated much more would be got.

Mr. *E. M. Lacy*, examined by Mr. SHIRESS WILL, said he was Consulting Engineer to the present scheme, which he thought would help to develop the district. Witness proceeded to give evidence in detail as to the sufficiency of the estimates for carrying out the proposed works.

In cross-examination, witness said the usual course in these schemes was to put up one station first; and in this case that at Stockport would probably be constructed for the supply of gas as well as electricity to Stockport. Since 1901, no big town had been excluded from these power schemes except by agreement.

Mr. SHIRESS WILL said in the cases he relied upon—Stockport, Darlington, Middlesbrough, and Bristol—there was a supply of electricity for power. But notwithstanding this, they were included; and he believed that since 1901 there was not a single case of exclusion except by agreement.

Questioned by the CHAIRMAN as to whether in any of the large undertakings the production of Mond gas and electricity had been combined, witness admitted that it had not been, except that the Mond gas plant was put up at Trafford Park.

The CHAIRMAN: Do you know any installation where it is going to be combined?

Witness: Only in the North-Western Power Act of last year.

In view of this fact, do you rely upon Mond gas, and Mond gas only, for producing electricity cheaper?—I rely upon that, and also upon having a larger generating station.

You will not have tramways. Do you think you can manufacture cheaper than those having tramways?—Yes.

Witness, in further reply, said if they obtained the whole of the area, including Stockport, they would be able to offer quite as good terms to manufacturers as any of the other power companies. He thought the area was as good as that of the Lancashire Power Company. He did not say that most of the electricity would be obtained from the Mond plant.

The CHAIRMAN: In view of the fact that the Mond Gas Company have not done anything yet, and that there is not a single large electrical plant that has Mond gas as driving power, and that the success of this scheme depends on the inducement held out that you are going to supply electricity cheaper from Mond gas, do you think it likely that people will put their money in?

Witness: I think so.

Suppose a large corporation were going to put an electrical installation in, would you, as an engineer, recommend them to run the risk of using Mond gas plant instead of steam?—I do not think there is the slightest risk.

Would you tell the corporation that they would be wise in running the risk (as I put it, because it is a new thing) of installing Mond gas? - Yes; I think the economies to be obtained would be worth the little risk they would take.

You, as an expert engineer, would stake your reputation by advising a large corporation to put down a gas instead of a steam plant?—Yes.

Further evidence having been given, the promoters' case was closed, and the Committee expressed a desire to consult together.

On the readmission of the public,

The CHAIRMAN announced that the Committee had come unanimously to the conclusion that the preamble of the Bill was not proved.

HOUSE OF COMMONS COMMITTEE.

Thursday, April 14.

(*Before Captain* JESSEL, *Chairman, Mr.* TREVELYAN, *Mr.* REID, *and Mr.* CROOKS.)

BARNET DISTRICT GAS AND WATER BILL.

This was a Bill to enable the Barnet District Gas and Water Company to acquire lands, to construct additional works, and raise further capital.

Sir R. LITTLER, K.C., Mr. BALFOUR BROWNE, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. D. C. BARTLEY appeared for the promoters. The petitioners in opposition were represented as follows: Herts County Council, Herts Rural District Council, and Hatfield Rural District Council, by Mr. CLAUDE BAGGALLAY, K.C, Lord R. CECIL, K.C., and Mr. C. C. HUTCHINSON; Middlesex County Council, by Mr. HARPER; Finchley Urban District Council, by Mr. WEDDERBURN, K.C., and Mr. H. SNOWDEN; the Marquess of Salisbury, by Lord R. CECIL, K.C., and Mr. HARPER; and the Metropolitan Water Board, by the Hon. J. D. FITZGERALD, and the Hon EVAN CHARTERIS.

Sir R. LITTLER, in opening, said the Bill was of great importance, not only to the Company but to the district. The area served by the Company was in a somewhat peculiar position in regard to water; being a sort of tongue stretching almost into London. It was within what was called Greater London; the districts to the east and west being supplied by the London Water Companies. These Companies, however, had neglected this area, because it did not pay them to come there. The promoters, who were formed by the amalgamation of two or three small Gas Companies, had undertaken the duty of providing water as well as gas within their district, and they had, at very considerable expense and under very difficult circumstances, established a water supply within the area. They had expended £255,000 in providing water, and were supplying 47 square miles, or about 30,000 acres, containing a population which was rapidly becoming urban. The increase of population in the portion of London in Middlesex had

been very remarkable; for whereas in the last ten years in the whole county of Middlesex the increase of population had been 47 per cent., in London the increase had been only 7 per cent. Of the 30,000 acres supplied by the Company, 18,200 were in Herts and 12,800 in Middlesex. The population was thicker in Middlesex than in Herts; but the tendency was for people to go further and further out from the centre of London. There were five urban and three rural authorities in the Company's district; but the only urban district that petitioned was Finchley. Since 1881, the number of houses and the population of the area had largely increased. In that year, the houses numbered 5636, and the population 31,600; but in 1901, the figures were 10,378 and 55,620 respectively. So that in 20 years both houses and population had nearly doubled. The Company had obtained power from time to time to raise capital, and about £25,420 remained unissued at the present moment. This sum, however, was subject to a deduction of some hundreds of pounds—the extent to which the water account of the Company was overdrawn. There could be no doubt the Company had been trying to do their duty to the district. The water they supplied had been described as perfectly beautiful; and there was no complaint in regard to it except that it was rather hard. The Finchley Council urged that it should be softened; but the water came from the chalk, and the application of lime or anything of that kind would really spoil it. Additional capital powers to the extent of £250,000 were sought. The estimate for the new works was £233,000; so that there was only a very small margin. The usual borrowing powers, as to one-fourth as much again, were also asked for. This capital it was calculated would enable the Company to proceed for 14 or 16 years.

The CHAIRMAN: Does the Bill deal only with water?

Sir R. LITTLER: Solely with water.

Continuing, Counsel said the Company obtained all their water by pumping—there being no means of obtaining water in the district except by wells—except a certain quantity supplied from the New River Company. This Company had now been taken over by the Metropolitan Water Board, and it was not probable that the promoters would in future get any large quantity from them. The Company had sunk five wells—three at Barnet, one at Potter's Bar, and one at East Barnet. In addition to these, there was a well at Finchley, which had cost £50,000; but it was now disused—no water having been found there. Though £40,000 had been expended on the well at Potter's Bar, only 250,000 gallons of water daily were obtained from it. During the past five years, they had pumped an average of 1,014,000 gallons daily; and the quantity supplied had been a little over 20 gallons per head. It was now a little less, because they had persuaded people not to waste the water. The supply now being given was not nearly what was suggested as proper for an urban population. Lord Balfour's Commission suggested 35 gallons per head daily; whereas the Company were managing with 19 gallons. With the increasing requirements in regard to baths and closets, it was clear that the present supply per head would have to be increased. The Company promoted a Bill in 1883; and then, as now, they were opposed by the Finchley Authority, who wanted a constant supply, a revision of rates, and softening of the water. There was a discussion for three days before a House of Lords Committee, and eventually they refused to put the Company under terms of an absolute constant supply—only requiring them to divide the capital as between their gas and water undertakings and to apply the auction clauses. The Company, believing they would obtain plenty of water, and not being desirous of another fight, unfortunately agreed, before the Bill went to the Commons, to give a modified constant supply in Finchley, subject to an appeal to the Local Government Board. Practically a constant supply was to be given to every place in Finchley that could be reached by gravitation from the Company's reservoir.

Mr. WEDDERBURN: What we are going to contend for is that we should have beyond all question under this Act a constant supply, and have it in a form which will give security against the kind of questions which have arisen in the past.

Sir R. LITTLER pointed out that, by alterations in the Bill, it was endeavoured to meet the Finchley Council. The Company were prepared to give a constant supply wherever it could be given by means of their reservoirs; and this, they believed, would mean a constant supply to all but a very small number of houses in Finchley. There had been very acute discussion in the past between the Company and the Finchley Council. Under a provision in the Act of 1883, the Company were to give a constant supply to every place which could be supplied without rising more than 300 feet above Ordinance Datum. The Company had always been anxious to carry out this obligation. Several Local Government Board inquiries had been held with regard to it; but while the Local Authorities of Finchley and Friern Barnet asked for a constant supply, they would not call upon their ratepayers to provide the fittings necessary for such a supply—it having been proved at every inquiry that the present fittings would not bear a constant supply. At last, regulations were submitted by the Company to the Local Government Board and approved. The Company throughout maintained that they had the protection as against Finchley that, in order to enter the district, they had to raise the water to a height of 317 feet, which was 17 feet higher than was specified in the Act. The Finchley Authority argued that this was not so, because it was only necessary to raise the water 317 feet in order to pass over a bridge. The Company suggested resort to the Law Courts to obtain a decision on the point; but the Council would never adopt this course. This really was the sum of the petition of Finchley. At a time when there were 1135 houses in one district, 1021 were inspected; and it was found that 949 had fittings which were not proper if a constant supply were to be given. The present pumping operations of the Company, which were almost continuous, showed that they were taking all the water that could be obtained, because there had been an average fall of 2 feet per annum in the level of the water. They therefore proposed to go to Little Berkhampstead, in the Lea Valley, where they were advised there was practical certainty of obtaining a supply adequate to the requirements of the Company. The site was not far from the Lea; but there would be no abstraction from the river, because it was proposed to tube the well, and thoroughly protect it with iron until it reached the chalk—thus only water which was flowing away to waste underground would be tapped. It was proposed to construct a reservoir at Shenley, and the necessary subsidiary works. Counsel then dealt at length with the various petitions. The County Council of Herts said they were most seriously interested in the maintenance of the water levels in the chalk formation of the county, and they feared that the proposed well would aggravate the injury already caused by the operations of the New River and East London Companies. The Company, however, Counsel said, had to supply twelve parishes in Herts, and, further, the well would be more than a mile from any existing well; and the Engineers stated that no instance was known of pumping affecting a well at that distance. The Company wished to use the water in the great underground reservoir; and there was all the difference between pumping water by the New River Company (say) for the use of London, and pumping water, as was here proposed, for the use of the neighbourhood. There should be no discrimination in the use of this water between neighbouring Middlesex and neighbouring Herts. Middlesex also took exception to the proposed well at Little Berkhampstead, which, though entirely in Herts, they contended would nevertheless prejudicially affect the supply of Middlesex. Thus each county said the proposal would hurt them. The Company must, however, get water; and he maintained that the proposed method would be fair and proper. The Metropolitan Water Board also alleged that the construction of the well would materially affect their sources of supply. But Counsel argued that a well so far from their district could not do them any harm.

Mr. *Henry Rofe*, in reply to Mr. HONORATUS LLOYD, said the reliable yield of the existing wells of the Company could not safely be put at more than a million gallons per diem. He calculated that the population of the district of supply was 63,000. Assuming that the population increased at the same rate as recently, he estimated that it would be 95,000 in 1921, and assuming that, as at present, they supplied 90 per cent., they would then have to supply 86,000 persons. In 1931, the number to be supplied would be 100,000; and at 25 gallons per head, the consumption would be 2½ million gallons daily. Thus it was obvious the Company must seek fresh sources of supply. He had inspected the site of the proposed well, and believed that the quantity required could be obtained there without doing substantial harm to anyone. The diminution of water in the Lea Valley was caused, not by over-pumping, but by defective rainfall. This was the view adopted by the last Royal Commission.

In cross-examination by Mr. WEDDERBURN, witness agreed that in Finchley there ought to be a constant supply; but it should be under proper conditions, the chief of which was that the fittings should be in order.

Mr. WEDDERBURN, in reply to the CHAIRMAN, said that Finchley at present was suffering very great inconvenience. The Local Government Board had done all they could to assist them, but in vain. If the Company would at once give a constant supply over so much of the district of Finchley as could be fed from the existing reservoir, and then, when they had the new reservoir, over as much more as could be fed from that, Finchley, on that point, would be content.

The CHAIRMAN: Is it not a question whether they have enough water to give it?

Mr. WEDDERBURN: It is not a question of the amount of water, but of the position of their existing reservoir.

Mr. TREVELYAN (to Mr. Honoratus Lloyd): You say you have the pressure if the reservoirs are full, but that you cannot count on them being full?

Mr. HONORATUS LLOYD: Yes; that is so.

The following clauses were handed to the Committee as having been agreed for the protection of Middlesex:

For the benefit and protection of the County Council of the Administrative County of Middlesex (in this section called or referred to as the County Council), the following provisions shall, notwithstanding anything in this Act contained unless otherwise agreed to in writing by the County Council and the Company, have effect—that is to say,

(1) It shall not be lawful for the Company to supply water in bulk or otherwise from their present sources of supply for use outside their present limits of supply.

(2) The Company shall not by agreement purchase, or acquire, or take on lease for the purposes of their works, any additional lands in the County of Middlesex exceeding 5 acres in the whole.

(3) The Company shall not upon any part of such additional lands, or upon any lands in the County of Middlesex acquired or taken on lease under the section of this Act of which the marginal note is "Power to take Lands," sink any well in the said county, but may thereon construct a reservoir or other works necessary or convenient for the supply of water in Middlesex.

In cross examination by Lord R. CECIL, witness said he estimated the population in the Middlesex portion of the Company's area at 40,000, and in the Herts portion at 24,000. The greater part of their water supply was being drawn from Herts; and the quantity obtained from the existing sources would be ample for the population in the Herts portion of the area. There was no land in Middlesex on which the Company could usefully sink a well. The effect of the clause agreed with Middlesex would be to prevent the sinking of any further well in Middlesex.

Lord R. CECIL: Therefore, for a population two-thirds of which reside in Middlesex, you propose to draw exclusively on Herts?

Witness: You cannot make a division between two counties like that; you cannot prevent one county getting water from another.

Continuing, witness said he should not object to protect Herts to the extent that Middlesex was protected by the clause with regard to the Company not sinking a fresh well on land obtained by agreement. The pumping proposed from the large reservoir beneath Herts would affect such a large area that it would not practically interfere with the water underground.

Cross-examined by Mr. HARPER: The Company were seeking by a clause to provide against electrolysis; but he did not know that was very unusual in a Water Bill. The Company did not enjoy the protection of such a clause in regard to any existing water-works.

Mr. HARPER: Have you seen the report of the Local Government

Board in which they say "this clause is very exceptional" and suggest whether it can properly be allowed?

Witness: Yes.

Can you tell me of any special circumstance peculiar to your Company which renders it desirable that they should receive such protection?—I think it desirable that every Company should receive such protection.

Mr. HONORATUS LLOYD, in reply to Mr. TREVELYAN, said the Company would like to give a constant supply in Finchley, but they used the provision as to the height of 300 feet as a legal weapon to oppose that claim because they had not sufficient water to give a constant supply.

Friday, April 15.

Sir R. LITTLER said he wished to make it clear that the promoters had not only no objection to give a constant supply to Finchley, but had every desire to serve the whole of the district to the best of their ability. Their difficulty had been that they were very short of water; and unless the fittings were in perfect order, there would be great waste if a constant supply were given. An assurance had now been obtained from Finchley that the fittings were in order, or in course of being put in order; and provided the Company were satisfied on this point, they were prepared to give a constant supply, within a reasonable time—say, by Jan. 1 next—to all places in Finchley which could be supplied from the existing reservoir. The Company were also prepared to reduce the period for the completion of the works from ten to five years, and to come under an obligation to supply from the new reservoir within five years, or earlier, if it and the subsidiary works were completed.

Mr. WEDDERBURN said these were the main points on which he opposed the preamble. He had prepared a clause containing practically the proposals of Sir R. Littler; but it was at the printers.

The discussion of the matter was accordingly postponed.

Mr. *R. E. Middleton*, examined by Sir R. LITTLER, said he was an Assistant-Commissioner appointed by the Royal Commission on Metropolitan Water Supply, of which Lord Balfour of Burleigh was Chairman, to inquire regarding the rivers, streams, springs, and wells of Herts. He thought it probable that the population in the Herts portion of the Company's area would considerably increase in future. At the present moment, the population actually supplied by the Company was over 54,000; and the quantity of water distributed in 1903 was 424,434,000 gallons. A water company had to provide not for the average, but for the maximum consumption.

The CHAIRMAN, interposing, said the Committee were quite satisfied that it was necessary that the district should have more water.

In further examination, witness said that the present supply averaged 21·54 gallons per head daily; but he thought this figure could not be maintained. The consumption when the population became more urban would increase probably to 25 gallons. Witness then gave details of the levels and output of the various wells of the Company. The proposed well at Little Berkhampstead ought to give a supply of 3 million gallons daily, which would meet requirements for the next 15 or 20 years. He could not say it was absolutely impossible that the proposed well would not have any effect on neighbouring streams; but, in his opinion it was extremely improbable that it would. He reported in 1893 that no permanent depletion of streams and wells in Herts had taken place, but that the fluctuations in the streams and wells were seasonal.

In cross-examination by Mr. BAGGALLAY, witness said the Company at present supplied on an average 1,200,000 gallons daily, and in a maximum week they might have to supply 25 per cent. more. As a continuing matter, he did not think they could rely on obtaining more than a million gallons daily from existing wells. They obtained more at present; but the level in the wells was steadily lowering.

Mr. BAGGALLAY: You propose, notwithstanding that you have untried sources within your district, to take powers to obtain 3 million gallons from outside your district, and to supply this not only in your district, but to sell it in bulk beyond your boundaries?

Witness: That is a usual power.

The CHAIRMAN: If the Company were deprived of the power of supply in bulk outside, would that satisfy Herts?

Mr. BAGGALLAY: No, sir. That would help to reduce the injury by postponing for a longer period the time when this district will want more water. One of my points is that they can take plenty of water from their own district; also they can take, if they choose, water in bulk from the Staines Reservoirs Joint Committee. I say there is no necessity for this at all.

In further cross-examination, witness said the main of the Staines Committee passed through Finchley, and there was no physical difficulty, except that the water would require re-pumping, in water being supplied from the main to the Barnet Company.

Mr. BAGGALLAY: Supposing the Middlesex portion of the district were supplied from the main, I take it that the existing wells——

The CHAIRMAN: That assumes the consent of the Metropolitan Water Board.

Mr. BAGGALLAY: There is power. It is merely a question of payment.

The CHAIRMAN: Supposing the Metropolitan Water Board do not want to let the water go, what position would you be in? You do not suggest that it should be compulsory?

Mr. BAGGALLAY: Oh, no. I only want to see what other sources are available. (To witness:) Has any approach been made by the Company to the Board with a view to getting a supply?

Witness: Not that I am aware of.

Mr. BAGGALLAY: Therefore, if there has been no request, there has been no refusal.

In cross-examination by Lord R. CECIL, witness maintained that additional pumping would not diminish the flow of the River Lea. It was impossible that the Bill could do serious injury to the water interests of Herts. Naturally the Company would not buy water from the Metropolitan Board if they could get it on their own place.

Mr. WEDDERBURN, interposing, said he had handed to the promoters a list of the matters he desired to raise; and he thought there was fair probability of his not having to trouble the Committee further. Therefore, he thought it best he should not take part in the discussion that day; it being understood he was not giving up any of his rights.

Mr. HARPER: I am in the same position in regard to Middlesex.

Mr. FITZGERALD (in cross-examination): Does it not occur to you that the site of the proposed well, being in the immediate proximity of the Lea, was selected so as to get a supply from the River Lea?

Witness: Certainly not. It is the natural place where one would expect to find a large supply of water. If it happened that the effect of sinking the well was to diminish the flow of the River Lea, the well would, in effect, be taking water from the Lea.

Professor *Dewar* stated that the water supplied by the Company at present, both chemically and bacteriologically, was admirable—being almost identical in character with the water supplied by the Kent Company. The supply of water from the proposed new source could not be better from the point of view of organic purity. Unnecessary expense would be incurred if the water were softened; and it would be unwise to soften it. He approved very strongly of clause 49 of the Bill, which said: "If any injury or damage occur to the mains, pipes, or works of the Company by fusion or electrolytic action caused by any electric currents generated or used by any county borough or district council, or any other body, company, or person for the purposes of electric traction or electric lighting or other analogous purpose, such council, body, company, or person shall make full compensation to the Company for any such injury or damage." The Company ought to have a safeguard, so that in the event of electrolysis occurring they should be compensated. Electrolytic action was caused by electricity finding its way back by the easiest road; and for this reason it used gas or water pipes to return. The danger came from the percolation of semi-sewage from the streets—a saline solution of moisture from dung and so on—which was electrolytic, and attacked the pipes.

Cross-examined by Mr. HARPER: If there was a leakage of electricity, there must be electrolytic action.

Mr. HARPER: Have you made any investigation as to whether there has been any trouble with the Company's pipes?

Witness: I thought it was a mere question of potential security.

Do you know of any case in which Parliament has inserted, by anticipation, a clause of this kind in a Water Bill?—I do not. I think it is a question for parliamentary authorities.

I gather from you that the danger diminishes in proportion as the work is well executed?—Precisely. If there is no leak, there will be no danger of damage.

By the Committee: The sewage of Little Berkhampstead was disposed of on the surface; and experience showed that filtration through 2 or 3 feet of soil removed all danger. There was no risk of contamination in this case.

Mr. *Middleton* was then re-examined by Mr. BALFOUR BROWNE: He said the power to supply in bulk to outside authorities proposed in the Bill had been found of very great convenience to outside authorities, as in the case of the East London Company recently. It might be convenient to the Barnet Company to supply another company, or to receive a supply from another company. The water proposed to be taken would be abstracted from a stream which flowed underground into the Thames; and if it were not taken by the Company, it would escape into the Thames, and do no good to anyone.

Mr. *Strachan* corroborated generally the engineering evidence already tendered. The Company required a further 2 million gallons daily, on the average, and 3 million gallons daily as a maximum. A disquieting feature in connection with the existing wells of the Company was that the level of the water was sinking about 2 feet per annum, which meant that more water was being drawn from the substratum than was flowing in to it. The scheme for a fresh supply was a good one from an engineering point of view. The new well would not cause permanent or general lowering of the level of the water in Herts. For a certain radius round the well, in the cone of depression, there would be a withdrawing of water; but beyond this area the effect would not be noticeable. The contention being that pumping in the Lea Valley had permanently injured the county of Herts was unsound, and not in accordance with the fact. There was not the least risk of pollution of the new supply from the sewage farm at Little Berkhampstead.

Cross-examined by Mr. BAGGALLAY: He agreed that if a permanent supply could be obtained from the Metropolitan Water Board, at a proper price, the Company should consider the offer.

Mr. *Whittaker*, F.R.S., stated that the proposed site was well situated for giving a large supply of water from the chalk.

In cross-examination, he agreed that in the north-west portion of the Company's district, water could be obtained from wells; but a well there would not be so satisfactory as one at the site proposed.

Monday, April 18.

Mr. *T. H. Martin*, the Engineer and Manager to the Company, examined by Mr. BALFOUR BROWNE, said their area of supply was diversified with heights varying from 130 feet to 468 feet; and this caused difficulty in affording a supply. A portion of the highest part of the district of supply was in Finchley. There were no streams in any part of the area, and there seemed to be very little underground water. At present, they could not count on more than a million gallons daily. Therefore it was essential that they should have a further and better supply, especially if they were to give a constant supply. It would be useless to sink more wells in the Company's own area; he knew of no place in their district at which they could find water. The proposed well was in a position to provide further water. It was in the Lea Valley, as was nearly all the Company's district; and as the Company were nearer the sources, they thought the people in the district had first claim on it. They were in fact a Herts Company, and would be more so when the locality was developed by the construction of railways extensions and tramways. The proposed reservoir was a necessary part of the scheme if a constant supply was to be given. It would be at the highest part of the district—468 feet above ordnance datum; and this elevation would be such as to enable a constant supply to be afforded to about two-thirds of the area.

Cross-examined by Mr. BAGGALLAY: Of the capital, £52,000 was

applicable to sinking a well at North Mimms, if the necessity arose. The Company did not contemplate sinking a well there; but if the population grew up rapidly, they might have to fall back, even after the construction of the new well at Little Berkhamstead, upon the source at North Mimms, where already they had a borehole. The Company had not refused to take water from the Metropolitan Water Board, and had not asked them for a supply. So far the ratio of increase of population had been considerably greater in the Middlesex portion of the area than in the Hertfordshire part. This would continue until Finchley was filled up; after that the turn would come of the portion of Hertfordshire beyond the district of the Company.

Cross-examined by Lord R. CECIL: It was not unusual for a water company to go outside their parliamentary district to obtain a supply of water. He did not know that an application had been made to include Finchley within the district of the Metropolitan Water Board.

Lord R. CECIL: What happened was this: Finchley said "Let us be put into the Metropolitan water area." Your Company resisted with all its strength; and the Government, who were in the position of the promoters of the Bill, stood aside and were neutral?

Witness: I have no recollection of that.

Mr. BALFOUR BROWNE denied the accuracy of the statement.

Cross-examined by Mr. WEDDERBURN: The only reason the Company could not give a constant supply over the whole of their area was that they had not the water to do so.

Mr. BALFOUR BROWNE said it was absolutely impossible to give a constant supply over the whole of Finchley (which was 5 square miles in area) at once; but the Company were prepared to supply a portion of it on Jan. 1 next, and to go on supplying it as fast as they could from the existing reservoir, and then, when the new reservoir was completed, they would give a constant supply over all Finchley.

Mr. WEDDERBURN then read the clause prepared by his clients, embodying the offer which he understood Sir R. Littler had made. It proposed the repeal of certain sections of the Acts of 1872 and 1883, and proceeded: "Provided that for a period of five years from the passing of this Act the water supplied by the Company within the district need not in any case be delivered at a pressure greater than that to be afforded by gravitation from the existing New Barnet reservoir, and from and after the expiration of the said period of five years, the water supplied by the Company within the district need not be constantly laid on under pressure to the premises of any consumer (or any part of such premises) situate at a level exceeding 400 feet above Ordnance Datum." Beyond this, of course, there was a point as to the fittings. The Company had all along said that, but for the barrier of 17 feet, they could supply Finchley constantly. It could not be a question of the amount of water, because the Company had obtained water from the New River Company in the past, and could get it from the Metropolitan Water Board in the future. Proceeding, he read the clauses which had been prepared by the promoters to give effect to the offer of Sir R. Littler, the result of which he said would be to give, if and so far as the rest of the district permitted, on and after Jan. 1 next, a constant supply in a very limited portion of Finchley—the part in which the Local Government Board had ordered that a constant supply should be given four years ago. Under that provision, there would probably have to be an arbitration to say whether the demands in other portions of the district allowed of a constant supply in Finchley. After Jan. 1 next, a constant supply was to be given "in such selected portions of the district (not exceeding 400 acres in extent), and within such times as (having regard to the varying surface levels in the district and the pumping necessary for the supply of water to the higher levels of the limits of supply) shall from time to time be reasonably required by the Finchley Urban District Council, and be agreed to by the Company, or, failing agreement, be determined by the Local Government Board, but so that the Company shall not be obliged to give a constant supply in any such selected portion of the district within twelve months after the commencement of the constant supply in the portion shown on the map, or, after the commencement of a constant supply, in any additional selected portion of the district." He submitted that this clause was very involved, and that it opened the door to arbitration after arbitration.

The CHAIRMAN remarked that the Committee did not think the clause went quite so far as Sir R. Littler had said he would go.

Mr. BALFOUR BROWNE said it went as far as the possibilities enabled the Company to go.

In further cross-examination by Mr. WEDDERBURN, witness stated that, when the Company had their new reservoir, they would be able to raise the level of supply up to 400 feet. With the present reservoir, they could supply water to a height of 320 feet, and were prepared to do so. He was willing to give a constant supply on Jan. 1 to the portion of Finchley in the area in which the Local Government Board said it should be given, and twelve months afterwards to give such a supply in another 400 acres, and so on.

Mr. WEDDERBURN pointed out that there were 3300 acres in Finchley; and therefore it would be nine years before the Company covered the whole district.

Witness replied that he should like to have the period of nine years; but a constant supply could be given more quickly than that if the Company obtained their Bill.

Mr. BALFOUR BROWNE: We must do it in five years.

Re-examined by Mr. BALFOUR BROWNE: The New River Company supplied the promoters with water down to 1901 at 1s. per 1000 gallons; but in that year they cut off the supply, and refused to allow the connection to remain.

By the Committee: The Company was supplying 20 gallons per head daily. With a constant supply, the consumption at first would run up probably to 30 gallons per head daily, and in the summer to even more.

This closed the case for the promoters.

Mr. CLAUDE BAGGALLAY, in opening for the Herts County Council, said it was not a large point (though it was of very great importance) that had to be settled as regarded his clients. The question was: Was a water authority to take water from what was in the nature of an adjoining district for the supply of its own population until it had exhausted the sources of supply within its own area? Obviously if there was not water inside a district, it must be obtained outside; but until information had been obtained as to how much was obtainable inside, resort should not be had to an outside area. The case for Herts was that the Company had not exhausted the possibilities of obtaining water inside their existing authorized district, or their opportunities for obtaining water in bulk or otherwise, before invading another part of Herts, which had water in it but which would require that water itself before very long. Mr. Middleton stated that the Company could obtain water in their district in Herts without going into other parts of the county; but he would not say to what extent. He also said that at Little Berkhamstead they would get it easily and certainly. Surely the Committee would not allow the Company to go to the outside parts of Herts unless it was shown that the cost of obtaining water in the Company's own area was prohibitive. There was not the slightest doubt that in the last 20 or 25 years the water supplies of Herts had been gradually and continuously falling, and the potent or patent reason was the pumping away of the water beneath the surface of the county, which had increased year by year. The Royal Commission stated that the amount of water which could be safely pumped from the River Lea was limited to 47 million gallons at the outside, and in certain cases to 40 millions; and the wells and pumping power now existed for taking nearly the whole of the quantity. The Company should be compelled to ascertain the result of their own well-sinking before going outside into other parts of Herts. It was all very well to say that other parts Herts did not to-day require water so urgently as the Metropolitan parts of the district. But the whole tendency was to increase; and these outer districts of Herts were only waiting the construction of tramways and light railways for a very large increase in population, in which case the water would be required for their own use. The loss of water to the county had become exceedingly serious; and he contended that, unless an overwhelming case of urgency was made out, the Company ought not to be allowed to go outside their district in order to sink a well. In conclusion, he suggested the possibility of a supply being obtained by the Company from the Metropolitan Water Board, whose mains passed through the district.

Sir *John Evans*, the Chairman of the Herts County Council, gave evidence in support of Counsel's statement, pointing out that the abstraction of water from the county had already seriously affected the springs and watercourses, and expressing the opinion that the proposed well would have precicely the same effect as if the quantity of water taken from it were abstracted from the Lea. The County Council objected to water being taken from the rural portions of Herts for consumption in Middlesex.

Mr. *A. L. Stride*, a member of the Highways and Parliamentary Committees of the Herts County Council, and Vice-Chairman of the Hatfield Rural District Council, stated that the latter authority's well was at Essendon, within a mile-and-a-half of the Company's proposed pumping-station. The well was sunk to a depth of a 130 feet at first; but it was quickly pumped dry, and had to be lowered to 198 feet, at which depth it yielded a good supply. He also spoke of the depletion of the water resources of the county. All down the Lea Valley the people recognized the public necessity to take water; but they held that it was not right that they should have their water further drawn upon so long as the Company had plenty in their own area.

Tuesday, April 19.

Mr. FITZGERALD stated that while out of the room the previous day, some questions were put to a witness as to the position of the Metropolitan Water Board in regard to the Barnet Company. The Board had never been approached on the subject of giving a supply of water to the Company, and therefore the matter had never been under their consideration. Until the evidence in this case on behalf of the Company was given, they had no means of ascertaining the facts, and were not aware of them. The Board would not enter into possession of the water undertakings of the Metropolis until June. Without making a pledge, he was authorized by the Chairman of the Board, and also by the Chairmen of the Works Committee and of the Law and Parliamentary Committee of the Board (who had all been present in the room during the proceedings), to say that they had the very strongest objection to the proposed well, and that if it was abandoned they were prepared to recommend the Board to give a supply of water to the Barnet Company on reasonable terms. Until a definite proposition was put before the Board, it was impossible to say more than that.

Mr. *Barnard*, a member of the Herts County Council and representative of that body on the Metropolitan Water Board, and a member of the Lea Conservancy Board, stated that it was most essential to Herts that there should be continuity of a good flow of water in the watercourses of the county. It would be most dangerous, in view of the past experiences of dry years, to sink a well at the site proposed. It sunk, it would diminish the supply of the Metropolitan Water Board.

Mr. *J. W. Restler*, the Engineer to the Southwark and Vauxhall Water Company, examined by Lord R. CECIL, said the limits of deviation of the proposed well were within 30 yards of the Lea, which, at this point, flowed over sand and gravel upon lime and chalk—practically bare chalk. The first effect of pumping would no doubt be to lower the level of water in the surrounding ground, and then, depending on the state to which the bed of the river was puddled, the water would flow from the river to the well. For many years past, the level of water in the Lea Valley had been insufficient to supply the area allocated by Parliament to the Companies whose source of supply was situated in the district. The East London Company had had to go to the Thames to supplement their supply from the Lea; and it was evident that the Valley of the Lea was taxed beyond its capacity.

Mr. *Urban Smith*, Surveyor and Engineering Adviser to the Herts County Council, stated that his experience of the water supply of the county confirmed the evidence of Mr. Restler. He considered that, if a well were sunk at Colney Heath, sufficient water for the needs of the Company would be obtained without material injury to anyone.

In cross-examinatiion by Mr. BARTLEY, witness said the 3 million gallons proposed to be obtained from the new well would amount to about 5 per cent. of the total water taken out of the watershed of the Lea.

At the suggestion of the Committee, further expert evidence on behalf of Herts was not called.

Mr. *Sworder*, the Clerk to the Rural District Council of Herts, which includes Bayford and Little Berkhamstead, stated that the proposed well would be about a mile from that which supplied the Rural District Council, and the inhabitants viewed with serious apprehension the loss of water they were advised would result from the proposed well.

Mr. *Woodhouse*, a member of the Herts County Council, gave evidence as to the lowering in recent years of the levels of the wells on his estate, which was contiguous to the proposed well, and expressed the opinion that, if constructed, the well would be very injurious to the Lea and to the springs of the neighbourhood.

This closed the case for the Herts County Council; and evidence was at once given on the petition of the Marquess of Salisbury.

Mr. *N. A. Mitchell* stated that he was in the employ of the Marquess of Salisbury at the Hatfield Saw Mills. In the year 1884, he obtained from the Lea 70-horse power; but this fell off to such an extent that in 1902 Lord Salisbury caused a steam-engine to be erected to do the work hitherto done by water power. The sinking of the well at Little Berkhamstead would still further deplete the supply.

Mr. *Cowan*, Agent for the Salisbury Estate, stated that any depletion of the wells which supplied Essendon and the village of Hatfield, would be very serious for the district. Lord Salisbury had four mills on the Lea; and in each case the water power available had practically diminished to nothing. The supply of water on which Hatfield House relied in case of fire, was pumped from the Lea; and therefore if the River Lea were depleted to the extent that the pumps could not be worked, it would be a very serious matter. The domestic water supply of Hatfield House was derived from a spring in the park.

The CHAIRMAN said the Committee would like some evidence as to the £52,000 set apart in the Bill to sink a well at North Mimms.

Sir R. LITTLER said North Mimms was in the Colne Valley. The Company had a boring there; but they were not at all hopeful of obtaining any quantity of water from it. Although they had proposed in the Bill to take power to spend money there, they would be quite content not to have the power, feeling certain that at Little Berkhamstead they would get the water they required; whereas they were not certain they would get it at North Mimms. Therefore, he was prepared to ask the Committee to strike out the power to spend money at North Mimms.

Lord R. CECIL then addressed the Committee, remarking that the case of Lord Salisbury was really a special instance of the way individual interests would be damnified, and that it was a number of individual interests which went to make up the Hertfordshire case, in addition to which there was the injury that it was admitted by everybody would be caused in the immediate neighbourhood of the well. Before being granted the power to sink the well, the promoters, he submitted, must show either that there was no reasonable probability of getting water elsewhere in their (the Company's) own district, or else that the well which they proposed would not be an injury to other wells and streams in its neighbourhood; and neither proposition, he urged, had been established. As to the first, they had it from Mr. Fitzgerald that the Metropolitan Water Board were prepared to give a supply on reasonable terms. Further, the Company already possessed a site for a well at Colney Heath—a district they seemed not to have examined at all, although the evidence showed that there was a considerable quantity of water to be obtained there. This was demonstrated by the fact that a well already existing there gave an ample supply. There was immense probability, if not certainty, that the Company could obtain a sufficient supply of water from that district. In addition to this, the Company proposed to spend £17,000 to extend the borings at the Barnet well, so as to increase the supply there. A further reserve was provided by the East London Company's Act, under which, in case of emergency, this district, among others, might obtain a supply of 35 gallons daily per head of the population from the Metropolitan Water Board. The sinking of the well would do very great injury to the people of Herts. Why were the Company not content to go to Colney Heath? They took capital powers to extend the boring there, they had the right to lay mains in the roads, and it could not be seriously argued that they would have any difficulty in obtaining the land. The Company had not made out that they could not obtain water elsewhere and that the taking of water at the site proposed would not be injurious to the county; and therefore the power to construct the well should not be sanctioned.

Mr. WEDDERBURN said that, having regard to the offer made on behalf of the Metropolitan Water Board, the Committee might desire to decide for or against the proposed well before hearing the Finchley case. He was willing to wait if they so desired.

The CHAIRMAN: The Committee would prefer to adopt that course.

Mr. WEDDERBURN said that in that event it would be understood that his opposition remained a preamble opposition.

The case for the Metropolitan Water Board was accordingly proceeded with.

Sir *A. Binnie* said the effect of sinking a well at Little Berkhamstead must be either to prevent some of the water in the chalk flowing into the Lea, or, in dry weather, to abstract water from the river itself. In either case the flow of the Lea would be diminished; and therefore the Water Board, who had purchased the whole of the waters of the Lea with the exception of the quantity required for navigation purposes, would be deprived of a certain portion of their water.

Cross-examined by Sir R. LITTLER: The question as to whether the Metropolitan Water Board should supply the Company for ever was one for negotiation. He did not know a case in which a water company permanently supplied another with water; but he had known a corporation to give a supply permanently to another area. The Board would not supply at cost price.

Mr. *W. B. Bryan*, the Engineer to the East London Water Company, gave corroborative evidence, and stated that some years ago one of the London Companies proposed to sink a well three-quarters of a mile west of the intended well of the Barnet Company, to which his Company objected, on the ground that their supplies would suffer, and the proposition was withdrawn.

Mr. FITZGERALD then addressed the Committee on behalf of the Metropolitan Water Board. He stated that they had never been approached by the Barnet Company, and they were not touting for a customer. They were present simply to defend themselves against attack. They objected strongly to the proposed well; but when they learnt from the evidence that the inhabitants of the Company's district were in want of water, it was only natural for the representatives of the Board to authorize him to make the proposition he had laid before the Committee. They might assume, he thought, that if the Company were willing to take a supply from the Board on reasonable terms, they would not experience much difficulty in obtaining it. He maintained that there were no legal difficulties in the way of such a course. The objection of the Board to the well was very strong, because, if sanctioned, it would mean that a considerable quantity of water to which the Board were now entitled, and for which they had paid, would be taken from them without any compensation. The site had been selected obviously on account of its proximity to the Lea and the springs which fed that river.

Mr. HARPER, representing Middlesex, said that, in view of the clauses agreed with the promoters, he did not propose to make any observations with regard to the preamble.

Sir R. LITTLER briefly replied on the whole case, pointing out the lateness with which the offer had come from the Water Board, and arguing that the Board had no power to give the supply they suggested, besides which they only proposed to give the supply on terms profitable to themselves. The Company were of opinion they could safely reckon on obtaining 3 million gallons daily from the proposed well; and if the Committee thought it right, they would come under an obligation not to pump more than this quantity in any one day. Further, if any well within a mile of the proposed well was appreciably affected, they were prepared to pay money compensation.

The CHAIRMAN, after a short consultation with his colleagues, said the Committee found the preamble proved, subject to the striking out of the capital power as to the £52,000 for the extension of the boring at North Mimms, and to the insertion of clauses limiting the pumping from the new well to 3 million gallons daily and providing for compensation should the pumping affect other wells within a mile.

Mr. WEDDERBURN: This is as regards the well alone. The preamble remains open so far as I am concerned.

The CHAIRMAN: Yes.

Friday, April 22.

To-day the Committee sat to consider and adjust the clauses of the Bill, when Sir R. LITTLER submitted clauses carrying out the decisions of the Committee.

As to a constant supply of water in Finchley, a clause was put forward by the promoters providing that the Company should afford a constant supply as regarded the portion of the district defined by the Local Government Board in 1899, after Jan. 1, 1905; and as regarded the rest of the area, within such portion thereof and at such dates as might be agreed to by the Company and the District Council, or, failing agreement, might be determined by the Local Government Board. On the other hand, a clause was submitted by the Finchley Council providing for a constant supply to the whole district after Jan. 1, except those parts situated at a level exceeding 400 feet above Ordnance Datum.

Mr. WEDDERBURN, on behalf of the Finchley Council, argued that the whole of the district built upon ought to have a constant supply, and denied that the Company had not sufficient water. A constant supply with good fittings required less water than an intermittent supply with bad fittings. They were only asking for what Parliament intended them to have in 1883. The clause of the Promoters meant that another five years would be spent in going from one tribunal to another.

Mr. *E. M. Eaton*, examined by Mr. WEDDERBURN, said waste was very readily detected with a constant supply; and with a little vigour in examining fittings, the consumption would fall below that of the intermittent supply. In the case of Sheffield, with which he was concerned, the constant supply was introduced in 1869. Before then the consumption was 21 gallons per head for a 12 hours a day supply. On the introduction of the constant supply, waste ran the consumption up to 41 gallons. On regulations being introduced, however, the consumption steadily dropped, and in a short time fell to 17 gallons per head per day for all purposes, or, excluding the meter supply for trade uses, to between 12 and 13 gallons, at which figure it had stood to this moment. If Finchley took 14 gallons per head per day for all except trade purposes, and 3 gallons for trade, this would make 17 gallons per head per day. Now 19¾ gallons were supplied; and therefore there would be a margin with a constant supply, which it was not proposed to take till the fittings were in order.

The Committee decided to adopt the promoters' clause, with certain amendments, striking out "so far as the existing wells of the Company and the requirements of consumers within the limits of supply will permit," and also the reference to the Local Government Board, and inserting the words "providing that the Company shall, within three years from the date of the passing of the Act, provide such constant supplies throughout so much of the district as can be supplied by gravitation from the existing reservoirs at New Barnet."

A new clause asked for by the Finchley Council, abolishing the charge of 12s. 6d. made by the Company for private baths in houses rated at less than £40 per annum was refused, as was also a clause desired by the Middlesex County Council compelling the Company to submit plans to the Council when mains were laid in subsidized roads. A clause asked for by the same Council in regard to the discharge of water into the streams of Middlesex was accepted by the promoters and inserted.

THE QUESTION OF ELECTROLYSIS.

Clause 49 of the Bill, dealing with injury to pipes by electrolytic action, was then considered. The clause was as follows:—

If any injury or damage occur to the mains, pipes, or works of the Company by fusion or electrolytic action caused by any electric currents generated or used by any county, borough, or district council, or any other body, company, or person, for the purposes of electric traction or electric lighting or other analogous purpose, such council, body, company, or person shall make full compensation to the Company for any such injury or damage.

Mr. *J. G. Newbigging* was called by the promoters, and examined by Mr. LLOYD. He said he had had twenty years' experience of laying mains in Manchester, where they had over 2000 miles of gas and water-pipes. He had had considerable experience of the damage caused to mains by electricity; and during the past few years, attention of the Manchester Gas and Water Committees had been called to this damage. During the three years they had had tramways working by electricity, cases of electrolysis had occurred both in gas and water pipes. Witness produced a specimen of iron water piping, which, he said, had been removed within the last few weeks from the ground in Manchester from underneath the tramways; and there was no doubt that it had been damaged by electrolysis. An analysis of the ground had been made, and absolutely nothing found to account for the damage. The pipe had been in the ground for three years, and it crossed the tramway lines. He then produced another specimen, which had been damaged by leakage from a cable. The clause, he said, sought protection both from traction and lighting. The damage practically amounted to a fusion. The pipe had been laid fifteen months. With regard to a specimen of an hydraulic pipe which he produced (pressure half-a-ton), witness said it was a pipe not more than three years old; and had it been corroded by the soil, the damage would have been more even. Electrolysis depended on the amount of electric current and the nature of the soil—whether it was moist and so on. Electrolysis removed lead twice as quickly as iron, because it was a purer metal. He had no doubt of the cause of the injuries he had shown. The damage was not discoverable easily, but went on very slowly until a leakage took place. It was said that the Board of Trade regulations were sufficient; but the tramways producing the damage he had shown were worked under those regulations. The departments of the Corporation in Manchester had the clause against each other. If the Electricity Department damaged a gas or water pipe, they admitted it, and paid. It was out of one pocket into the other, certainly; but in the case of the Barnet Company it would not be so, and therefore protection was necessary. Knowledge was increasing day by day on this matter. When the Board of Trade made these regulations, they had had no practical experience of electrolysis; but now evidence was accumulating slowly. Of course, they did not expect that either the gas or water services would be inconvenienced all at once; but evidence was growing to show that the regulations did not give absolute protection. The clause asked for was certainly very fair and reasonable, because the damage would have to be proved.

Cross-examined by Mr. HARPER, for the Middlesex County Council, witness admitted that he had been engaged in several of these cases, and had brought his specimens of pipes; and that every time special protection had been refused. They had not in Manchester been to the Board of Trade, because there was no necessity for it—the Corporation owning all the undertakings. The tramways had been inspected by the Board of Trade before they were allowed to be worked. He saw the returns which had to be made according to the Board of Trade regulations; and the tramways were worked well within these regulations. His contention was that the regulations did not give the requisite security. The tramway was 2 feet above the pipe produced; and the soil was ordinary loamy earth, having no constituent that could hurt the pipe without the electric current. He did not know of an instance where Parliament had been asked to prevent electrolitic action which might come into being afterwards.

Mr. LLOYD: Such precedents as these are in Traction Bills, not in either Gas or Water Bills.

Cross-examination continued. The current passing into the pipe did no harm; it was on leaving the pipe that it carried off the metal. It cut away the pipe where there was resistance at a joint, which might be gas or water tight, but not electricity tight. He was not an electrical engineer; but he understood the subject. The degree of damage done depended on the current, but also on the conditions and the length of time the current was passing through the metal. The regulations ought to be altered, because the Board of Trade framed them on theory, not on practical evidence.

Cross-examined by Mr. SNOWDEN (for the Finchley Urban Council), witness said he thought that if the water or gas pipe came after the electric lighting cable, the lighting authority should still be liable; but not if it could be proved that the armour of the cable had been eaten away in consequence of a leakage from the water-pipe.

By the COMMITTEE: The Board of Trade regulations limited the leakage to the ground—that was, the current returning to the negative terminal must not exceed 5 per cent.; and the difference of potential between the earth and pipe was also stated. But even if these conditions existed, electrolysis would take place. It was a question of time. It was only fair to seek to make the common law of the land what was now done between the departments in Manchester.

The CHAIRMAN: Is there not a remedy at common law?

Mr. LLOYD: No, because Parliament has authorized them to work in accordance with the Board's regulations. The Board years ago made regulations. We find that these regulations are not effective, and that, even if adhered to, damage is still done. We therefore ask you to go further.

The Committee decided to strike clause 49 out of the Bill.

The remaining clauses having been gone through, the Bill was ordered for report.

Chelmsford Water Scheme.—At a special meeting of the Chelmsford Town Council last Friday, the Water Committee recommended the acceptance of tenders for the construction of a concrete reservoir at Long Stomps and the supply and laying of mains. It was explained that the Local Government Board approved of the engineering part of the scheme; but so far the Council had not received the Board's written consent, and the question was whether they were prepared to carry out the work without this consent. In the end it was decided to definitely accept the tender for the pipes, and the other two subject to the approval of the Board. A deputation was afterwards appointed to wait upon the Board to urge the necessity for immediately granting permission to borrow the money.

HOUSE OF COMMONS COMMITTEE.

Wednesday, April 13.

(*Before Captain* JESSEL, *Chairman, Mr.* TREVELYAN, *Mr.* REID, *and Mr.* CROOKS.)

AMERSHAM, BEACONSFIELD, AND DISTRICT WATER BILL.

This was a Bill to confer further powers on the Amersham, Beaconsfield, and District Water Company, and to include the district of Gerard's Cross within the area of supply.

Mr. FREEMAN, K.C., appeared for the promoters; while the only petitioners, the Rickmansworth and Uxbridge Valley Water Company, were represented by Mr. TALBOT.

Mr. FREEMAN, in opening, said the promoters had been authorized by two Provisional Orders to supply water in Amersham, Beaconsfield, Chalfond St. Giles, and other adjacent districts; and the object of the present Bill was to include the district of Gerard's Cross in their area. There was no question that Gerard's Cross was badly in need of water. At present there was no public supply whatever. The Bill was supported by the County Council of Buckingham, by the Eton Rural District Council, and the Parish Council of Gerard's Cross; these authorities having all passed resolutions in its favour. There was also a very strong petition in favour of the Bill signed by nearly every landowner in the district proposed to be served. The only opponent was the Rickmansworth Water Company, who had also introduced a Bill this session to give them authority to supply the parish. Their Bill was defeated on second reading in the House of Commons. It would be interesting, therefore, to ascertain on what ground the Rickmansworth Company opposed the measure. In 1900, the Rickmansworth Company obtained certain powers to extend their area. The Company stated that they thought that in the area they had included Gerard's Cross; but, as a matter of fact, Gerard's Cross had some years previously been formed into a separate parish, and as it was not mentioned separately in the schedule of the Order of 1900, it was not included in it. In 1901, the petitioning Company sought power to extend their district—not, however, having the inclusion of Gerard's Cross; but, being opposed by the County Council, the Bill was withdrawn. In 1902, without any authority from Parliament, they commenced to lay mains in Gerard's Cross. These pipes, however, were summarily removed by the Local Authority. In 1903, the Amersham Company applied to the Board of Trade for a Provisional Order authorizing them to supply the parish; and they were supported by the County Council. The Rickmansworth Company, however, stated that it was only by a mistake that the parish was omitted from their Bill of 1900; and they succeeded in persuading the Board of Trade to refuse the Order to the Amersham Company, on the express ground that they were to have one more opportunity of inducing Parliament to give them this area. The Bill which the Rickmansworth Company had accordingly promoted was the one which had just been defeated on second reading; and therefore the only Bill now before Parliament was the one under consideration.

A number of witnesses were then called, who bore out generally Counsel's statement.

Mr. *R. H. Rushforth*, the Secretary to the promoting Company, said that they had power to issue considerable further capital. Their operations hitherto had been successful, and had given satisfaction. They had entered into an undertaking that, if the Bill were passed, they would furnish a supply of water to Gerard's Cross within the next twelve months. They had the water to do so; and there would be no difficulty in laying the mains.

Cross-examined by Mr. TALBOT: There was no doubt that when the petitioners obtained their Bill of 1900, they were under the impression that Gerard's Cross was included in their extended area of supply. It was because the Company refused to give an undertaking not to take water from the county of Buckingham for the supply of places outside, that the County Council refused them authority to break up roads for which the Council were responsible. If the Amersham Company supplied Gerard's Cross, they would have to lay longer mains than the Rickmansworth Company; and this extra length would be to a large extent unproductive.

Mr. *W. Crouch*, the Clerk to the Bucks County Council, said that body attached great importance to preserving the water of the county for the county. This was one of the reasons why they opposed the Rickmansworth Company.

In cross-examination, witness held that water should not be taken out of the county unless an equivalent quantity was brought in again. Questioned as to what bearing this principle had upon the case of Gerard's Cross, which parish was wholly within Bucks, he said that, assuming the Rickmansworth Company desired to take water out of the county, they would be greatly convenienced in doing so if they had the power to supply Gerard's Cross. During negotiations in 1902, the Rickmansworth Company were asked to give an undertaking that they would not to take water out of the county to any greater extent than they brought water in; and they refused.

Mr. TALBOT said his clients thought the principle an absurd one; but they were willing to concede it. If they agreed to give the undertaking referred to now, what objection had the County Council to giving their consent to the Company continuing their mains into Gerard's Cross?

Witness replied that, judging from the discussions he had heard at meetings of the County Council, he did not think that body would be inclined to entertain the proposal.

Mr. *Disraeli*, M.P., an Alderman of the Bucks County Council, said that body had passed a resolution in favour of the Amersham Company's Bill as against that of the Rickmansworth Company. He had no reason to suppose that, if the latter Company were again allowed to introduce a Bill, the County Council would support it. The offer of the Rickmansworth Company to give the undertaking was rather a deathbed suggestion. It was not made until after their Bill had been thrown out on second reading.

In cross-examination, witness said the Bill of the Rickmansworth

Company threatened the whole of the county water supply, because it proposed to allow a large extension of area to a Company who would give no undertaking as to pumping. The Rickmansworth Company supplied in the counties of Buckinghamshire, Hertfordshire, and Middlesex; but he did not know that the first-named county was supplied with water obtained from the last.

This closed the case for the promoters; and evidence was at once called for the petitioners.

Mr. *J. W. Restler*, the Engineer to the Southwark and Vauxhall Water Company, and Consulting Engineer to the promoters, produced the plan which was before the Committee in 1900, when the Rickmansworth Company obtained power to supply, among other districts, the parish of Chalfont St. Peter. The Rickmansworth Company had no idea at that time that Gerard's Cross was not a portion of Chalfont St. Peter, and for this reason it was omitted from the schedule to the Act of that year. Careful inquiry was made, and the Company were told that Gerard's Cross was only an ecclesiastical parish. They were unaware that it was a separate civil parish. The mistake was not discovered until the end of 1901, when they sought to lay mains in the disputed area and were stopped.

By Mr. TREVELYAN: Negotiations had taken place with regard to the supply to Gerard's Cross, it being suggested that the Rickmansworth Company should give such an undertaking as had been referred to if they were allowed to take over the obligation; but the Company held the view that it was absurd that a geographical matter, such as a county boundary, should apply to water supply, the natural boundary being the limits of the watershed. As a matter of fact, the taking by the Rickmansworth Company of water out of Bucks had never been contemplated.

Mr. TALBOT said the argument which went to the root of this matter was supplied by the map, which showed that the parish in question was quite cut off from the district of the Amersham Company and was almost entirely surrounded by the district of the Rickmansworth Company. Supposing there was no question of the parliamentary relations between the two Companies, or of the relations between the Companies and the Local Authorities, no sane person would ever propose that, as between the two Companies, the parish should be given to the Amersham Company. Obviously if any Company other than the Rickmansworth Company were to supply there, there would have to be a large unremunerative expenditure on mains. A more preposterous waste of capital and confusion of areas could hardly be imagined than was proposed by the promoters. The county principle in regard to water was absurd. The counties of England had not had their boundaries fixed with any regard to watersheds. He could understand the principle that water should not be taken from one watershed into another; but what logic or reason was there in a suggestion that because water happened to be within the borders of a county, therefore it should not be supplied to a place just over the border? Parliament had continually acted in a way that was opposed to any such principle. It was particularly absurd here, because the Company supplied in three counties, and a large area of Bucks was supplied with water from Herts. It was obvious that counties would be placed in the greatest difficulties if the county principle were adhered to. What could be more ridiculous than to say that no more water should be taken from Bucks than was supplied to it. Therefore he maintained that the Rickmansworth Company were right in resisting the proposed undertaking in 1902. The Board of Trade upheld their contention, and decided that they were the people to supply the parish, and for that reason cut out the parish from the Order of the Amersham Company on the express understanding that the Rickmansworth Company would promote a Bill to supply it. What happened in the House of Commons in regard to the Bill afforded a singularly cogent example of the danger of dealing with matters of detail, such as were contained in the measure, on the floor of the House, because it was perfectly plain that Parliament never had its attention directed to what was the real issue so far as it affected Gerard's Cross —the question of which of the two Companies ought to supply the parish. No doubt, following on the decision on second reading, the Rickmansworth Company could not obtain until next year parliamentary powers to supply there; but if the present Bill were out of the way, and the consent of the road authorities were obtained, they could supply in a few weeks. He urged that the road and local authorities had absolutely no reason now to withhold their consent, seeing that the Company were willing to give the undertaking for which they had been asked. In that case, the supply would be given before the promoters could give it. In these circumstances, he asked the Committee to refuse to sanction the Bill.

Mr. FREEMAN briefly replied, pointing out that Mr. Talbot had really been asking the Committee to reverse the decision of the House on the motion to read a second time the Rickmansworth Bill, and asserting that their willingness to give the undertaking was merely a deathbed repentance.

The Committee found the preamble proved; and the clauses having been adjusted, the measure was ordered to be reported.

The Local Government Board and Village Water Supplies.—According to the "Local Government Journal," the Board at Whitehall have come to the help of a village in the Knaresborough rural district. It was proposed to charge 10 per cent. on the rateable value for water supplied to cottages which were without a proper supply. The Board did not agree with this proposal, and in a communication to the Council said: "Under the proposed scale of charges, if adopted, the revenue to be derived from the actual consumers of the water would be less than half of the annual cost of the water undertaking, and there would be an annual deficit, which would have to be raised by special rates levied upon the contributory place. The Board do not consider this an equitable arrangement. They are of opinion that, as far as practicable, the cost of the water undertaking should be borne by the consumers of the water." The Council have now raised the scale to 20 per cent. This relieves the rates of all burden, and places upon the water consumers the cost of the supply. The decision is interesting to rural councils.

GROWTH OF LOCAL INDEBTEDNESS.

In the course of his speech on the Budget last Tuesday, the Chancellor of the Exchequer (the Right Hon. Austen Chamberlain) made the following remarks on the above subject: We sometimes hear it said or suggested that the great fall in the values of Government stocks and all high-class securities in recent years is wholly due to the extravagant borrowings of the State. In a time of great war you must borrow; but I think that if we examine the matter a little more closely, it will be seen that other causes have been at work to reduce the price of gilt-edged securities, and that, if national stocks and the stocks of local authorities are to regain their old credit, local authorities as well as the Exchequer must agree to restrict for a time their demands on the Exchequer. At the close of the year 1901-2, the latest for which figures are available, the total outstanding loans of local authorities in the United Kingdom amounted to £412,000,000. For England and Wales, figures are available to show the growth of this indebtedness during the last 20 years. In England and Wales, the total outstanding loans in 1880 were £137,000,000. In the ten years from 1880 to 1890, this amount was increased by £62,000,000; in the ten years from 1890 to 1900, it was further increased by £95,000,000; while in the two years of 1900-2, the amount was increased by no less a sum than £49,000,000. That is to say, the present rate of increase is 2½ times as great as it was in the period between 1890 and 1900, and more than four times as great as between 1880 and 1890. In the 20 years between 1880 and 1900, while in England and Wales the local indebtedness increased by £157,000,000, the gross capital liabilities of the State were reduced by £132,000,000. But when the State was forced again to become a borrower, owing to the exigencies of a great and prolonged war, there was no compensatory restriction in the demands of the local authorities. In the three years ending March 31, 1902, the local authorities of the United Kingdom borrowed upwards of £103,000,000. The total sum added to the National Debt on account of the war, which disturbed the equilibrium of four financial years, is therefore only just about 4½ years' borrowings of local authorities in the United Kingdom at the present rate of progress. Of course, a great part of this local indebtedness is incurred in fulfilment of new obligations which the House thrusts upon the local authorities. I think this may perhaps give us some reason to pause before we continue to place so many new obligations upon them. And it is true also that a very considerable portion of the indebtedness is invested in remunerative undertakings, or at least in undertakings which it is hoped will prove to be remunerative. This does not alter the fact that for a great mass of these liabilities the resources of the ratepayers are either directly or contingently liable. Sooner or later, it will be necessary to call a halt in this process of mortgaging the future. Despite the great success of the recent issue of the London County Council, there are many signs that local authorities are less welcome visitants to the Money Market than was the case a few years ago. Discouraged there, they naturally turn to the State to help them in their difficulties. The Local Loans Fund was established in order to give local authorities, and especially those not in a favourable position to borrow "on their own," the advantage of the superior credit of the State. But the State is entitled to discriminate between the demands which are made upon it. It is not tolerable that, after they have spoiled the Money Market by their own large demands, local authorities should be in a position to force the State into the market so spoiled. In order to check this process, and in order to preserve the Local Loans Fund against loss which would have been incurred otherwise, the Treasury have already been obliged to make an all-round advance in the rates which the Public Works Loan Commissioners charge. I am considering, in conjunction with my right honourable friend the President of the Local Government Board and with the Public Works Loan Commissioners, whether it may not be advisable to still further restrict these loans to those authorities who are least able to borrow upon reasonable terms for themselves, and to those purposes which the House has specially desired to encourage. The State cannot continue to provide money with as lavish a hand as in recent years, now that money is dear, and the savings banks no longer afford us as large resources as formerly.

Kimberley Water-Works Company, Limited.—The 24th annual general meeting of the Company was held last Wednesday, at the Cannon Street Hotel. Mr. James Jackson, who presided, stated that the year had been marked by exceptional circumstances, for the rainfall was only 9 inches, or about half the average of the previous 30 years. The sales of water, however, though 3 million gallons less than in 1902, were still the largest since 1889, with the exception of those of the years 1901 and 1902. The consumption for the first quarter of the current year was 2,750,000 gallons in excess of that for the corresponding quarter of the period under review. During the twelve months, the Company had established a record for cheap pumping. Subsequent to the last general meeting, an extraordinary meeting had been held to confirm the provisional agreement entered into between the Company and the Town Council of Kimberley for the extension of the concession; and a Bill embodying the proposal had passed through the Cape Parliament. The Board could thus speak more freely of the danger which had threatened the property of the shareholders. A large and influential section of the inhabitants were in favour of the town constructing its own works at all hazards. If this had been done, in spite of the apparent advantages which the Company already possessed and the efficiency of their works, the borough authorities would have been enabled to hamper them in such a way as to make them sell their works at almost any price. The terms obtained, although short of those for which the Board fought, were sufficient to preserve to the Company a valuable property; and, granted that the consumption of water continued up to the average of that of the last ten years, and that opportunities of cheapening cost which they might reasonably expect occurred, the shareholders could look forward to a continuation of the payment of fair dividends under the new conditions. He concluded by moving the adoption of the report and the payment of a dividend of 5 per cent. for the year; and the motion was carried.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, April 14.

(*Before Mr. Justice* GRANTHAM *and a Special Jury.*)

Benning v. Ilford Gas Company—Damage Caused by Last Year's Floods.

This was an action brought by Mr. Granger William Benning, a property owner, of 33, Doré Avenue, Manor Park, against the Ilford Gas Company, to recover damages for injuries done to his property by last year's floods; the allegation being that the defendant Company had committed a breach of a statutory duty, and had also done certain things to divert the course of the Aldersbrook, whereby the water had accumulated in such a way as to cause widespread damage among property owners in the district.

Mr. MONTAGU SHEARMAN, K.C., and Mr. J. R. CRAWFORD appeared for the plaintiff; Mr. LAWSON WALTON, K.C., Mr. H. E. DUKE, K.C., and Mr. MEYER represented the defendants.

Mr. SHEARMAN said this was a case which involved very important interests on both sides. Mr. Benning complained that, owing to the action of the defendants, his land was flooded in June last year. He said the Company's acts led to the damage, and he might have to go so far as to declare that their acts could not be justified, even though they had statutory authority to acquire the land they had purchased. Just at the spot where the Ilford Gas-Works were situated, the River Roding ran and went on its way to the Thames; it being affected by the tide. Close by was the Aldersbrook—a stream which he understood was originally the bed of the Roding, and it represented the boundaries between Ilford and East Ham. A large volume of water came down the Roding from the watershed of the district; all the land around there being low-lying. The position in question was two or three miles from the Thames. The Aldersbrook was a sort of alternative channel which had always been useful as a safety-valve in carrying off the flood water; and in very wet weather the water was prevented from going on to the land by a sort of embankment. By immemorial custom, the people who owned land there were bound to keep the walls of the embankment in repair. He did not think the obligation to repair was found in statutes, but it had always been enforced by juries. When the Company acquired from the late Marquis of Salisbury the land where the works now stood, they became subject to the obligation to keep the wall of the embankment in repair, in order to protect the inhabitants from the result of flood water; and the plaintiff complained that on a certain day in June last year the wall gave way, the neighbourhood was flooded, and damage done. Prior to 1889, the Gas Company applied for parliamentary powers to use the land for the purposes of a gas undertaking; and the Act provided that the Company might close, fill in, and appropriate and use the bed of the channel of the Aldersbrook from the bridge carrying the Romford Road, provided that if they closed any part of the brook before the expiration of three years from the passing of the Act, they should make and maintain, till the Barking Road bridge had been reconstructed, a cut or culvert from the Aldersbrook to the Roding through the existing land; that was to say, they had to make provision for taking away the water which would otherwise flow down the Aldersbrook. He believed this bridge was not reconstructed at the time of the flood. The Company had closed the Aldersbrook, but they had not made the cut; and he believed that what they were going to say was that the Act empowered them to close the Aldersbrook after three years without doing anything; and that they were protected by their Act. But the evidence he should call would show that this was entirely wrong. It was clear the Legislature thought it would not be safe to close the Aldersbrook till the bridge in question had been reconstructed. There were three years in which that was to be done; and the time expired in June, 1902. He understood the first thing the Company did after getting their Act was to lay two large gas-mains, nearly 3 feet in diameter, through the Aldersbrook, and entirely close part of it. He should contend that this was closing part of the stream before the three years in question had expired; and that being so, the defendants ought to have made a cut. In 1901 they built a bridge which also caused certain obstruction by its piers. They next decided to divert the Aldersbrook, and made another channel into the Roding. All this was done in three years. In June, 1903, there was great rainfall; the bridge was partly choked, and the water began to find its way down the Aldersbrook channel. It became penned up in the upper part of the stream, and a large reservoir was made behind the embankment. No doubt if the wall had been strong enough, there might have been no damage; but the Company seemed to have put the pipes through the wall, and filled up the space in the most casual way. The result was that the water got through. Therefore his first cause of action would be that they neglected their statutory duties in not opening up a culvert; and his next point was that, even if they were not bound to do this, they were negligent in the way in which they maintained the wall referred to. By the general law, if a person used his property in such a way as to allow water to come up and damage other property, he was liable; and in this case it was clear that the Company must be held to be liable. When the floods subsided in June, the Company not only mended the wall, but put it higher up; and soon after a much heavier rainfall came, and no water passed over the land. He therefore submitted that this was very strong evidence that if the work had been done properly at first no damage would have been caused.

Mr. *G. W. Benning*, the plaintiff, was then called, and described the floods which took place at Ilford in June last. He said the footings of his houses were below the river level. On the Monday night after the floods commenced, he found the water in the houses about half-past nine in the evening. There was a scene of great excitement at the time, and people were being taken away in boats.

In cross-examination by Mr. DUKE, witness said his land was lower than the river, and the footings of his houses were below the roadway. He had seen the marshes flooded in 1888 to a greater depth than they were last year.

By his LORDSHIP: In the previous floods, the water came over the land, but to nothing like the extent it did last year.

Mr. *A. H. Campbell*, the Engineer and Surveyor of the East Ham District Council, said he considered the defendants had stopped the Aldersbrook in an unskilful and negligent manner. They ought to have closed it at the point of entrance. The safety of works of this character depend upon the regulation of the inlet so that it corresponded to the delivering capacities of the outlet. The bank had been weakened initially by the cut which had been made for the insertion of the pipes, and it collapsed at the weak point. Unless there was a safety valve, a dam was sure to give way sooner or later.

In cross-examination, witness admitted that last year there was an extraordinary rainfall; but he was not aware that in a few days before June 15 as much rain fell as in the whole of the previous year.

Mr. *W. J. Channen*, a blacksmith, said he was in the service of the defendants at the time the pipes were put through the wall. The hole was made, the pipes were inserted, and the same earth lightly rammed in again.

Other witnesses gave similar evidence.

Mr. LAWSON WALTON for the defendants, said the plaintiff must establish that what the defendants did was wrongful, and was also the cause of the damage of which he complained, before he could succeed. If the cause of the damage was natural flooding, with which nothing the defendants did or omitted to do had any connection, then the plaintiff could not succeed; and it would be most unfair to cast on the defendants the blame for what took place. There was one very important point. The plaintiff had said that his property was flooded at half-past nine on the Monday evening, whereas the defendants would be able to prove that at that hour the wall of the river was whole, and did not give way till half-past two the next morning. This would be unshakeable proof that the damage done by the flood was not due to the breach in defendants' wall. As to the question of the neglect of a statutory duty, he should show that the construction of a conduit and a bridge and the opening of the wall for the insertion of the pipes were all done quite apart from the powers conferred by the Act. These things were done by the defendants on their own ground, and with the consent of the River Commissioners. They were the owners of the land, and were entitled to do these works, providing they carried them out with the consent of the authorities who were charged with the maintenance of the works necessary to protect the district from floods. They did not close the Aldersbrook during the three years mentioned in the Act, but he contended that at the end of that time they were entitled to do so, and they commenced by putting in the bank. Both plaintiff and defendants were alike victims of the general calamity of flood. If the plaintiff's property was flooded, defendants' machinery was stopped, the fires were put out, and they suffered as acutely as anyone. It was a general calamity for which the defendants could not be held to blame.

Mr. *J. H. Brown*, formerly Engineer and Manager of defendants' works, said the wall which gave way was well and properly put in.

Monday, April 18.

On the hearing being resumed this morning,

Mr. *A. A. Johnston*, the Engineer of the defendant Company, was called, and produced his report on the flood. He said at the highest point the water was 12 inches over the top of the wall, and flowed over it for five or six hours before the wall broke. It gave way about 2.45 in the morning, when witness was present. The breach in it was about 23 feet long; and the whole of the backing was washed out of it at the back of the breach. There was no indication that the wall had given way from being improperly made up. In his opinion, the wall was correctly made.

James Thomas Radley, the foreman of the main-layers, said he overlooked the laying of the mains which were put through the wall, and the work was well and properly done. Mr. Brown told him to have the holes rammed well and tight; and the work was solidly carried out. It was not true that the men were told to lightly ram the work.

Mr. *W. Whitely*, the District County Surveyor, said the large increase in the number of buildings in Ilford would bring more water down the river.

Mr. *A. C. Hurtzig*, a partner of Sir B. Baker, also gave evidence as to the details of the work of the river walls.

This closed the evidence.

Mr. SHEARMAN said there were points of law which no doubt raised difficulties in the case. But he said, on the authorities, that if, in the opinion of the Jury, the defendants, by letting the water on to the plaintiff's property as they did, created a nuisance, then it did not matter whether they had statutory power or not; and he asked his Lordship to leave to the Jury the question whether the defendants did not, by their acts, create a nuisance for which they were responsible. The next question was whether they exercised ordinary care and caution in the method by which they closed the Aldersbrook. Then the Jury should be asked if the defendants exercised ordinary care and discretion in the way in which they put their mains through the wall, and whether the floods were brought about by natural causes or by the acts of the defendants. The question of whether or not the defendants closed the Aldersbrook was more one for his Lordship.

Mr. DUKE then summed up the case for the defendants, submitting that they had discharged their duties in every respect.

Mr. SHEARMAN, on the other hand, asked the Jury to say that the whole of the damage caused by the flood was due to a nuisance created by the acts of the defendants. It did not matter at what particular moment the wall yielded. It was beyond doubt that the damage was caused by the wall of the river giving way; and the blame for this was obviously upon the defendants, as they neglected to take reasonable precautions in making the wall good.

Justice GRANTHAM, in summing up the case, said there was no doubt a good deal of the damage was caused by the stopping up of the

Aldersbrook. The Company had power by their Act to do this; but if done before three years, they were bound to put in a culvert up to the Roding. The first question for the Jury was whether the defendants had been negligent in the way in which they had placed their mains through the old river wall. The next, and more important question, which was one of some difficulty, was whether the damage was caused by the defendants stopping up the Aldersbrook in the way they had done. Assuming they had a right to block it up, did they do it in a reasonable way, or ought they to have known or suspected that their blocking of it would lead to the water flowing over? Another question was whether the injury to the plaintiff was brought about by natural causes, such as a flood which no one, including the defendants, could have anticipated.

The Jury retired. After having a short deliberation in private, they returned into Court, and gave a verdict on all points in favour of the plaintiff.

Mr. SHEARMAN said the question of damages would be referred to the Official Referee.

Mr. MEYER asked for a stay of execution, as there were several of these actions pending, and it might save unnecessary expense.

Mr. SHEARMAN said he must object to the inquiry as to damages being delayed.

After some discussion,

His LORDSHIP refused to stay the inquiry as to damages, but ordered that if the Referee awarded a sum for damages, execution for it was to be stayed in view of an appeal by the defendants on the question of liability.

SHOREDITCH COUNTY COURT.—Tuesday, April 19.

(*Before His Honour Judge* SMYLY, K.C.)

Ives v. Gaslight and Coke Company—Liability for the Reinstatement of Pavements.

This was an action brought to recover damages for injuries sustained by a little boy named Ives, aged six years, who, on Christmas Day last, met with an accident outside his father's house, No. 64, Appleby Street, Kingsland Road. The workmen of the defendants had taken up two paving-stones, dug a trench, and fixed a service-pipe to the house on the 23rd of December, finishing the work about four or five o'clock in the afternoon; and it was alleged that they had broken off the corner of one of the stones, and had so carelessly refilled the trench that a portion of the stone projected about an inch above the surface, and that the hole caused by the piece being chipped off the stone had not been filled up. The boy caught his toe in this hole, fell, and cut his eye, and had to be taken to the hospital.

Mr. LEVER appeared for the plaintiff; Mr. A. NEILSON represented the defendants.

The boy's father and mother, a friend, and Edward Hickmott, a lad ten years old who was taking the plaintiff out for a walk when the accident occurred, all swore that the particular paving-stone that had been lifted had had a piece chipped off.

Mr. NEILSON called, on this point, the workmen of the Company who had fixed the service-pipe, and a mason named Bates who re-set the pavement for the Shoreditch Borough Council on Dec. 29, all of whom swore that the stone with the piece off was not one of those lifted, and that the men had properly restored the surface of the pavement before leaving it on Dec. 23.

Mr. *W. C. Wigley*, Divisional Inspector of the Company, was called to prove that, under section 114 of the Metropolis Local Management Act, 1855, the Borough Council had elected to do the repairing and re-laying of pavements after the Gas Company's work had been completed. He said he had sent the Council the notices required by the Act; the one to reset having been given on Dec. 24.

Mr. NEILSON submitted that, a contract having been entered into with the Shoreditch Borough Council under the provisions of the Metropolis Local Management Act, the liability for the non-repair of the portion of the street where the accident occurred, if there were any non-repair, was shifted from the Company to the Council.

Judge SMYLY: You must either leave the stone safe or unsafe. If it was left safe, of course there is no liability; but if it were left unsafe, why should you not be liable?

Mr. NEILSON: We say that, in fact, we did leave it safe.

Judge SMYLY: If it is proved that it was unsafe, how does the agreement with the borough authorities help you?

Mr. NEILSON: The moment we have completed our work, it is the duty of the borough authorities to see that their portion is done.

His HONOUR suggested that there was not reasonable time to do it before the 25th of December.

Mr. NEILSON said there might be good reason for not doing it earlier than they did; but the proper notice having been given to the Council, the Company's liability had terminated. He submitted that where such a contract as the one which had been made in the present case existed, the Company could not be made liable unless they were grossly negligent. He also urged that he was entitled to succeed on the question of fact.

Judge SMYLY said he did not think the point of law arose in the case, because it was the duty of the Gas Company to leave the place reasonably safe when they went away, or to put something there to prevent anyone walking on it. He thought the responsibility rested on the Company during the interval of completing their work and the Borough Council doing theirs, and that there was no unreasonable delay, considering that Christmas Day and Boxing Day were at hand, and that the Council's men could not be expected to do the work on these days. The sole question, therefore, was: Did the Company's men go away leaving the place in a safe condition? After critically reviewing the evidence which had been adduced, he gave judgment for the plaintiff, with £6 6s. damages.

Mr. LEVER applied for costs on the higher scale; but the application was refused.

BOW COUNTY COURT.—Wednesday, April 20.

(*Before His Honour Judge* SMYLY, K.C.)

Price and Others v. Gaslight and Coke Company—Claims for Wages in Lieu of Notice.

To-day his Honour had before him actions brought by three men named Price, Frost, and Goddard, who had been employed on a night shift at the Bromley Gas-Works of the Gaslight and Coke Company during the winter months, to test their right to a week's wages in lieu of notice, in consequence of their having been discharged at the end of the season.

Plaintiffs appeared in person; Mr. VAUGHAN WILLIAMS represented the Company.

Price said Mr. Martin, the foreman, started him on the 20th of November at night work, and dismissed him on the 10th of March at four hours' notice, as the work was down. He and others complained to Mr. Lacey, the Manager, who told them they were daily servants. Plaintiff replied that their money was not there at night-time when the work was done, and that they could not get it until the next day. He had worked for the Company in the winter for some nine or ten years. When he was engaged, nothing was said about notice on either side. The wages were paid weekly on Saturdays; but if they wanted to draw their money before, they were not wanted the next day. His earnings varied from 6s. 3d. to 6s. 8d. per night.

In cross-examination by Mr. VAUGHAN WILLIAMS, witness said there were no men now at the Bromley station who had written agreements for 28 days' notice, so far as he knew. He had sometimes, in previous years, signed such an agreement himself, and was entitled to 28 days' notice. Casual men had to be there every night, but could not get their money till the morning. If a man wanted his money the following day, he had to dismiss himself to get it, and could obtain it at ten o'clock; but if he was working in the daytime, he could get his money at once. About 30 or 40 men were working in the same house as he was; but they were not all dismissed at once, as he heard that Mr. Lacey went round the next morning and gave some of them a week's notice. If at the end of the season they told the foreman they had got a better job, they were allowed to go without giving notice. He thought the four hours' notice he received was too short, as some of the men were warned two days before he was; but he was away on account of illness for two days the last week he was at the works.

Judge SMYLY remarked that all contracts for personal labour were subject to the man being fit to do it.

Frost said he was engaged on the 3rd of December and discharged on the 10th of March; but did not work on 25th and 26th of December, as he was told he was not wanted. A month before the discharge, the workmen were talking of the likelihood of work ceasing. The 10th of March was the first time he heard anything about notice.

In cross-examination, witness said he had been in the Company's employ, off and on, for twelve years. Four or five winters ago some of the men had written agreements; but he did not know of any winter hands having them now, though the "all the year round men" did. He had frequently known of men leaving at short notice; and when he was a signed man he was allowed to leave on giving three days' notice. Though this was to please himself, yet it was with the consent of the Company. He had at other times told the foreman he should like to leave in about a week, and had been allowed to do so.

Goddard said he had worked for the Company for eighteen winters and four summers. Nothing was said about notice when he was engaged on the 3rd of December. On being dismissed on the 10th of March, he complained to Mr. Lacey, who told him he would have to go. Last year the Manager at the Bow Common works gave him six days' notice; but when he was a signed man he had a month's.

In cross-examination, witness said he had heard two days before his discharge that the house was going to be shut down. He was told not to work on Christmas Day or Boxing Day; but he wanted a holiday then, like everybody else.

Mr. *H. Martin*, the foreman at the works, said men without signed agreements did not receive a week's notice; but they were told when work was going down to look out for another job. He had mentioned to the men that there was a likelihood of the work ceasing early in March; but Price was not told so, as he was away two days in March. There were about twelve casual hands in that gang, and about 60 altogether who were discharged on the 10th of March; but none of the others had taken proceedings. During his 25 years' experience, the same course had always been pursued.

Judge SMYLY said if it were a contract for a week's notice, it would be one on either side, though this was not always strictly enforced. A man going away without giving such notice would then be liable to pay his employer a week's money in the same way as the employer would have to pay it to the servant he sent away without the notice. He had therefore to find out whether there was a contract by which both parties were bound. The men had given their evidence very fairly; but he did not think there was any contract for a week's notice. Some of the plaintiffs had received notice when they were signed men; and in this instance it was perfectly clear that the men, with the exception of Price, who was absent from work at the time, had been warned that the work would cease. There would be judgment for the defendants.

Mr. VAUGHAN WILLIAMS said he would not apply for costs. He added that he was instructed to say that if any of these men applied for work next year, this case would not stand in their way.

Judge SMYLY: I think it is quite right to say so, because these things do stand in their way sometimes.

At the meeting of the Huddersfield Town Council on Wednesday, the minutes of the Water Committee included a recommendation for the acceptance of the plans of Messrs. George H. Hill and Sons for remedying the leakage of the Butterley reservoir; their estimate of the cost being £75,000. The Committee had also accepted the tender of Mr. John Scott, at £78,490 for the works. The minutes were passed.

A MUNICIPAL PURCHASE OF GAS-WORKS IN ONTARIO.

Last Tuesday, the Judicial Committee of the Privy Council, consisting of Lords Macnaghten, Davey, and Lindley, and Sir Arthur Wilson, gave judgment in an appeal from a decision of the Court of Appeal for Ontario on Jan. 26, 1903, affirming one given by Mr. Justice Lounts. The suit arose out of an arbitration by agreement between the Kingston Light, Heat, and Power Company, and the Corporation of Kingston, Ontario, as to the price or value of all the works, plant, appliances, and property of the Company used in lighting the city by gas or electricity under an option to purchase by the Corporation; and the question at issue was whether the value (estimated at $80,000) of the franchise, goodwill, rights, and earning power of the Company during the remainder of the time for which their Charter powers were indefeasible should or should not be taken into account in fixing the purchase price. The Arbitrators awarded the Company in all $170,373; but (one dissenting) they decided that the Company were not entitled to any sum as the value of the franchise or rights conferred upon them by the Act under which they had worked, or to any amount representing the 10 per cent. addition provided for by a section of that statute in the event of expropriation. From this decision the Company appealed to the Canadian Courts, which, in the result, upheld the award of the majority of the Arbitrators. The arguments were heard in February. Lord Macnaghten, in delivering their Lordships' judgment, said they entertained no doubt at all that the questions raised by the appeal had been rightly decided by the learned Judges in Ontario. It appeared to their Lordships, as it did to the Courts below, that the terms of the agreement were conclusive against the appellants' claim to receive compensation for the franchise and goodwill. The general word "property," on which the appellants' argument turned, was limited, as were the other substantives with which it was coupled—viz., "works," "plant," and "appliances"—by the words which followed, which were "used for light, heat, and power purposes." It was impossible to suppose that the ideas of franchise and goodwill were meant to be included in this description, which was one of physical objects. But the matter was made still clearer by what followed. The 15th article of the agreement showed the true position which the franchise held in the conception of the parties; for under it, in the event of the Corporation taking over the works under the agreement, "all their . . . franchises" were to be surrendered to the Corporation. The other claim—for 10 per cent.—was untenable; for this was not a case of expropriation, but of transfer of property under voluntary agreement. The grounds of judgment thus adopted by their Lordships were those of the Court of Appeal; and they were so well stated in the judgment of that Court that it was unnecessary to amplify them. Their Lordships would therefore humbly advise His Majesty that the appeal should be dismissed, with costs.

Dispute about a Gas-Meter.

At the Congleton County Court, last Tuesday week, before his Honour Judge Brown, K.C., and a Special Jury, the Kidsgrove Gas Company sued Mr. C. W. Shirley for £11 7s. 10d. for gas supplied and rent of meter. At the outset of the proceedings, Mr. Harris, who represented the defendant, disputed the jurisdiction of the Court; contending that, under the Gas-Works Clauses Act, any question as to the correctness of a meter-index must be taken before two Justices. Mr. Raby, for the Company, however, cited a case that had been taken in the County Court; and the Judge ruled in his favour. It appears that for two years the defendant had paid his gas bills regularly; but in March, 1903, he disputed the correctness of the meter, which registered a consumption of 42,900 cubic feet, against 18,000 feet the preceding quarter. The Company, in order to test the meter, placed a new one side by side with it, and in this way found out that the old meter was registering 6 per cent. fast. The meter was then removed, and tested first by the Company, then by the makers, and finally by the Government officials at Salford; and in all cases the result was precisely the same. The Company then offered to allow Mr. Shirley a special abatement of 10 per cent. on the accounts for the first three quarters of 1903 in addition to the usual discount; but this was refused. Mr. Harris said his client did not object to pay for the gas he had consumed; but he did most strongly object to pay for what he had never had, as he firmly believed was the case in the present instance. There had been no more gas burned in the March quarter than previously; and he was willing to pay for an equitable amount based on the corresponding quarters. After hearing evidence, his Honour told the Jury there was only one point for them to decide, and that was whether the meter was substantially correct or altogether incorrect and unreliable. After an absence of twenty minutes, the Jury found that the meter was "altogether incorrect and unreliable;" and Mr. Harris claimed this as a verdict for the defendant. The sum of £5 1s. 10d., which had been paid into Court, was, however, handed over to the Company.

Gas Workers' Wages at Manchester.—The Manchester Gas Committee intend to increase the minimum wages of all men employed at the gas-works to 25s. a week; the present minimum being about 23s.; The change, it is said, will cost the Corporation £1400 a year.

Gas for Municipal Dwellings.—The Bermondsey Borough Council considered last Tuesday a report from the Housing Committee, in which it was stated that, it having been decided to light by gas the extensive blocks of workmen's dwellings now being erected by the Council in Fulford Street, the Secretary of the South Metropolitan Gas Company (Mr. Frank Bush) had informed the Committee that the Company would be prepared to put in fittings and piping for the supply through prepayment meters, the extra charge per 1000 cubic feet recouping them for the outlay. He further stated, in answer to an inquiry, that, in the event of the Council deciding to have the electric light in the buildings or staircases, or on the staircases only, the Company would still be prepared to provide "slot" meter supplies in the tenements. The Town Clerk was authorized to sign the form of consent required by the Company from landlords.

MISCELLANEOUS NEWS.

RICKMANSWORTH GAS ARBITRATION.

Monday, April 18.

(*Before Sir* GEORGE LIVESEY, *Umpire.*)

An Arbitration Inquiry to fix the price to be paid by the Rickmansworth Urban District Council to the Rickmansworth Gas Company for the transfer of their undertaking commenced to-day at the Surveyor's Institution. Mr. H. E. JONES was Arbitrator for the Council, and Mr. J. HEPWORTH for the Company.

Mr. A. WEDDERBURN, K.C., and Mr. F. N. KEEN appeared for the Company; and Mr. J. G. TALBOT and Mr. F. G. THOMAS represented the Council.

Mr. WEDDERBURN, in opening, stated that the Company was formed in 1852 as a non-statutory concern. It was a local venture to meet the needs of the district, and it went on from 1852 to 1885 without statutory powers. By 1885 the Company had gradually grown; but the shareholders were getting comparatively small dividends, and had spent a good deal which might have gone to paying dividends. In 1885 they applied for a Provisional Order; and before that their capital had risen to £10,733. This was original capital; and there was additional capital in shares to be issued not exceeding £5000. The total was therefore £15,733; but they had the power to go for more capital, either by Provisional Order, or, if they chose to go to Parliament for full statutory powers, they could get further capital. The dividends were limited to 10 per cent. on the original capital of £10,733, and to 7 per cent. in respect of the additional capital of £5000. All the capital was issued for the £15,733, except a small sum of £233. Loans by mortgage had been raised. By 1902, the business of the Company had considerably grown. The growth of the district had been largely influenced by the Metropolitan Extension Railway. There could be no question that, owing to the extension of the railway, there had been very considerable development of the district, and an increase in the consumers of gas. The gas area consisted of Rickmansworth urban, Rickmansworth rural, and Chorley Wood. The rateable value of these places in 1898 was as follows: Rickmansworth urban, £15,408, buildings without agricultural land, in 1902, £22,726; Rickmansworth rural, 1898, £8723, rising to £10,076; Chorley Wood, £4894, rising to £7044. There was no gas in Chorley Wood. The quantity of gas sold, taking a period of ten years, in 1893 was 8¼ million cubic feet, and in 1902 17½ millions, or more than double. He did not think there could be any question that, had the Company continued as it was without any more capital, its position was one of very great security, owing to the fact of the growth. More customers would have come in, and they could have gone on improving their position. But finding that they were successful, and that the increase was rapid, they thought it was better to apply for more capital. The result was that in 1902 they went to Parliament for a Bill to clothe themselves with statutory powers, and to get additional capital. Their going for the Bill might, he thought, be described at once as a sign of their success and as a cause of their destruction. If ever there was a case of compulsory sale, this was one. Having alluded to the Company's Bill of 1902, and the Act of 1903, the Purchase Act, Counsel said the result was this: The Court had, first of all, to take the Company as it would have been if the Act of 1902 had not been passed—they had to take it looking at it with its existing capital of £15,500 issued, and its £233 unissued; but they had also to bear in mind that it must not be said that it was absolutely dead, because it always had the power to come, by Provisional Order, for further capital. When they had assessed the amount, they had to add 10 per cent. for compulsory purchase. He felt inclined to say in this case that the ultimate object the Court would have in view was to see that the shareholders in the Company did not suffer. Their property was going to be taken from them against their will; and the net result ought to be that they should run no risk of any loss, either in the present or the future. Between the Council and the Company, there stood the individual who would find it exceedingly unpleasant if, by reason of the award, he was to have a less income in the future than he now had. He need not refer to the efforts made for agreement.

The UMPIRE: There were efforts for agreement.

Mr. WEDDERBURN said efforts had been made; but the Company thought them out of all reason. One arrangement had been come to which the Umpire might think very reasonable. This was that only two witnesses were to be called, apart from giving them any special facts they might want. The Company had never paid their maximum dividends. Since 1897, they had paid on their original capital 6¾ per cent., and on their additional capital 4¾ per cent. The question was what was the maintainable income; and when one used the word "maintainable," the question of security came in. The year they proposed to take was 1902, and to leave the mortgage debt out for the moment, because they deducted this from the capital. Taking 1902 as a fair year, he was going to ask them to find that there could be no question that the income of that year would not in the future leave them. There could be no question of this; so that they had an absolutely secure income. He thought the Company would have earned higher dividends, and probably be able to pay back-dividends. For the last seven years, the payments of dividend had been steady; and there was a rise on what had been steady for three years previously. It would be stated in evidence that the income during 1902, having regard to the nature of the security, ought to be multiplied by 28½ years. He thought he was entitled to use the fact that he did not press for back-dividends, and for the increased profits, as a conclusive argument for his having 28½ years. The only other addition beyond 10 per cent. for compulsory purchase was that something extra should be allowed for surplus works. As they had works which enabled them to make a greater amount of gas than in fact they were now manufacturing, he was going to ask them to add a sum of £1190 in respect of these

surplus works—he asked for the structural value of the works. The only deduction the Court would have to make was the deduction of the mortgage debt—£3933.

Replying to the UMPIRE as to whether the Company did not deduct the interest upon that,

Mr. WEDDERBURN said they had not done it that way. They had deducted the mortgage debt from the capital.

Mr. *Corbet Woodall*, examined by Mr. KEEN, stated that he was well acquainted with the circumstances of the Rickmansworth Gas Company. He advised the Directors in the preparation and conduct of the Bill which they promoted, and which was passed, in 1902. He had on several occasions visited the works and the district of supply. The accounts of the Company had been analyzed by Mr. Keen; and he had based his valuation of the undertaking upon the figures therein disclosed. Speaking generally, he was of opinion that the property of the Company to be transferred was a very valuable one, having the assurance of continued increase. The Company were established rather more than fifty years ago, and had enjoyed the privileges, and fulfilled the obligations, attaching to parliamentary sanction since 1885. The district was a very pleasant one. The facilities afforded by electric trams and workmen's cheap trains were tending to crowd the main suburbs with cottagers, and to push those of somewhat ampler means further afield; and Rickmansworth and Chorley Wood came within this lengthening radius. The following statement of rateable values showed what had been the development of the district during the past five years, and the future promised a still more rapid rate of increase: Rickmansworth urban, September, 1898, £15,408, September, 1903, £22,726; Rickmansworth rural, 1898, £8723, 1903, £10,076; and Chorley Wood, 1898, £4894, 1903, £7044. The increase of rateable value in Rickmansworth was due partly to re-valuation; but at Chorley Wood he was informed new buildings accounted for the whole. At the latter place there was at present no gas supply. The quantity of gas sold was in 1893, 8,366,000 cubic feet, and in 1902, 17,489,000 cubic feet; the increase in nine years being 9,123,000 cubic feet, or 109 per cent. The number of consumers in 1894 was 216, in 1902, 656; increase 440, or 204 per cent. Of the 656 consumers at the end of 1902, 274 were ordinary and 382 prepayment. At the end of 1903, the numbers were 283 and 387 respectively. The last two years had shown an increase in gas sold of 3·6 and 2·7 per cent. respectively; the previous seven years having averaged over 10 per cent. per annum. The reduced rate of increase was accounted for partly by the uncertainty of the Company's position with the natural reluctance to increase the capital expenditure due to that position, and partly to the mildness of the winter months during those years. From the statistics, the inference was reasonable that the profit balance of the Company would be a growing one, and that, had it continued its operations, it would have been in a position to pay full dividends within a comparatively short time. The Act, however, by subsection 3 of clause 83, shut the Company off from any advantage to be derived from the passing of the Act. By sub-section 6, the capital account was closed; and so it was impossible for the Company to cultivate the field which was ready to their hand. The certainty of future growth added greatly to the value of the undertaking as it stood—making more stable than would otherwise be the case the profits already earned, and upon which the value would be calculated. From the Accountant's tables, it was seen that the total revenue had been progressive during the five years 1898 to 1902. The balance of revenue account had necessarily not been so constant as the total revenue, but showed conclusively that the profit in 1902 was not likely to be diminished. After giving a summary of these figures, and quoting other statistics, witness said the standard price for gas authorized by the Order of 1885 and the Act of 1902 was 4s. 7d. per 1000 cubic feet, subject to the sliding-scale. The price charged had varied since 1890 between 4s. and 4s. 5d., after allowing for the 3d. discount for payment within a month. The price charged at the end of 1902 and since was 4s. 6d. with a discount of 3d. Alluding to repairs and maintenance witness went on to say that the average expenditure of the last five years upon this account was raised to 8¼d. per 1000 cubic feet, including part wages of the Manager and Inspectors. This was much above the sum necessary to maintain the whole plant in a thoroughly efficient condition; the average sum required being, in his opinion, from 5d. to 5½d. per 1000 cubic feet. He adopted the figure of 5¼d. as a proper expenditure upon maintenance in 1902. The value of a gas undertaking with parliamentary incorporation he took to be 28½ years' purchase of its maximum dividends or maintainable profits, whichever might be the smaller amount. This meant that shareholders would receive such a sum as would, when invested in other securities, yielding 3¼ per cent., give an income equal to that surrendered. The Company had excellent prospects had they the opportunity of taking advantage of them. By the Council's purchase Bill, however, they were debarred from enjoying the prospects opening up to them; and this fact should place them on the highest possible scale for purchase. As to the works, mains, &c., the works were fairly well equipped for the business done; and in most of the essential items there was a surplus. Other parts of the plant had, however, at the end of 1902 not been properly brought up to the necessary standard. Upon making an analysis of the plant as it existed in 1902, he had come to the conclusion that the excess plant was not only quite sufficient in value to counterbalance any deficiency in other directions, but showed an excess value of £1190. The deficiencies of plant, excepting only the station meter, had, since the account year (1902) been made good from money authorized to be borrowed from the Company's bankers. His valuation was as follows: Balance of revised revenue account for year 1902, £1233 16s. 8d.; add income-tax, £63 8s. 9d., £1297 5s. 5d. Less profit on fittings, £27 10s.; corrected gas profit, £1269 15s. 5d. This, multiplied by 28½ years, equals £36,188. Add £27 10s., multiplied by five years—fittings profit, £137, equals £36,325. Add 10 per cent. for compulsory purchase, £3632, made £39,957, and add surplus works, £1190, brought out a total of £41,147. Deducting mortgage debt, £3933, left a sum of £37,214. This total valuation was subject to deduction for floating liabilities of the Company hereafter ascertained.

In cross-examination by Mr. TALBOT, witness said the works were now in very fair order. The amount of expenditure had been very slight. He did not think they had spent £1000 since 1902 on works of renewal; he was sure they had not. The purifiers had been too small because it was a growing business.

Mr. TALBOT: You do not suggest that this district is increasing as a gas district very rapidly?

Witness: Yes; I think so.

Replying to Mr. JONES, witness said he thought the future in front of the Company was a very bright one indeed. The price of 4s. 6d. per 1000 cubic feet for the gas was, he thought, a maintainable one.

Answering Mr. WEDDERBURN, witness said he was acquainted with the recent Nantwich arbitration case, where about £80,000 was awarded; 27 years being allowed for a non-statutory Company.

Tuesday, April 19.

Mr. *F. H. Jones*, examined by Mr. THOMAS, gave evidence on behalf of the Rickmansworth Urban District Council as to his visits to the works of the Company, and his familiarity with the undertaking. He considered 4s. 6d. per 1000 cubic feet a very high price to charge for the gas. Having been examined at length in regard to the various items of claim, he said his valuation of the property was as follows: Profit, £1233, as per balance-sheet; deduct £47 overcharge, £1186; add £63, income-tax, £1249; deduct £196 for wear and tear (difference between 8½d. and 5½d.), £1053; deduct £217, interest on loans, £836; deduct £27, profit on fittings, £809. This sum, multiplied by 20 years' purchase, which was the term he gave, amounted to £16,180; and adding £1618, 10 per cent., and £137 for fittings, his total valuation came to £17,936.

In cross-examination by Mr. KEEN, witness said he did not regard this as a particularly well kept-up Company. He considered 20 years' purchase a very fair period, and not a low figure.

Mr. KEEN: Has not the time come when Rickmansworth, having been in the past a slow place, is now launching out and growing into a position which would have enabled the Company to go on well?

Witness: Of course, it is possible that that is so.

Mr. H. E. JONES: Do you think that any gas undertaking in the world could, under such circumstances, go on advancing satisfactorily when the price charged for gas is 4s. 6d. per 1000 cubic feet.

Witness: I do not think so.

In the course of discussion,

The UMPIRE said that Counsel need not go into the question of the loans. The interest on the mortgage loan would be deducted first.

Mr. TALBOT said he assumed that the Court had in their minds the whole of this question.

The UMPIRE: In my mind, the question is what is to be the number of years' purchase.

Mr. TALBOT: And the income.

The UMPIRE: Yes; that is a matter for consideration. But the question is: What should be the number of years' purchase. One witness says 28½ years and another 20 years.

Mr. TALBOT, in summing up the case for the Council, said that while shareholders in an undertaking ought to be guarded against loss upon its transfer, that transfer should not be made an occasion for their making more money by the transaction than that to which they were entitled. After alluding to the deductions to be made from the Company's balance-sheet of £1233 profit, Counsel submitted that all they were entitled to was a total of £17,936. With regard to capital deduction, he referred the Court to sub-section I, section 5, of the Act of 1902, providing for notice by the Council to the Company of their intention to purchase the undertaking, and thereupon the Company should sell to the Council, and the Council should purchase, the undertaking subject to all their then existing debentures, mortgages, obligations, and liabilities. He took it that there could not be any dispute between them that "then" meant the date of the notice.

Mr. WEDDERBURN: No; I think it means the date of the transfer.

Mr. TALBOT thought they were all agreed that it was fair, going down to 1902, to deduct the interest on the loans from the gross profits. Inasmuch as the undertaking was, so to speak, stereotyped in 1902, he thought that this should come off by way of a capital deduction; and he submitted therefore that any increase in the debentures, mortgages, obligations, and liabilities between the balance-sheet of 1902 and the date of the notice or the date of the transfer—whichever should be thought the correct construction of the section—should be deducted from the capital sum the Council were liable to pay as compensation, because the undertakers had only their undertaking to sell subject to this burden, and the Council had to discharge the burden. He said, therefore, that this should come off the compensation. There was a difference of £2000. He thought part of this sum was attributed to the costs of the Act of 1902. So much of the loan incurred as was attributable to the Act of 1902 he did not ask to be deducted if his learned friend stated that the discharge of so much of the bankers' loan would be taken by the Company in lieu of any claim they had under the second sub-section.

Mr. WEDDERBURN: When you pay the amount of the bankers' overdraft, if there is a certain portion of it which is in regard to the cost of the Act of 1902, we should have to say that we do not ask for that.

Mr. TALBOT said he thought that statement was quite sufficient for him. The question arose whether the Company had spent enough on the maintenance of their works out of revenue. Theoretical evidence had been given as to the experience of other undertakings; but they were in this case on stronger ground, because their contention was confirmed by the state of things they found actually existing. As to leakage, they had on their own figure 13½ per cent.; whereas the Council put it 4 per cent. higher. But even this was a very serious indication of the condition of the works, and a significant confirmation of what Mr. Jones had said—that as much had not been spent on the maintenance of the works as there ought to have been. It was some indication of the policy of starvation of expenditure on the undertaking that they found between 1901 and 1902. How far was the income of the Company maintainable? They were told by Mr. Woodall that it was practically as safe as Consols. They had, of course, to deal with this Company as if they had not obtained the powers of 1902. They were

then in the position of a Company with most unsatisfactory works; their capital had been spent; they had come to the end of their tether; and they had not money to spend upon their existing undertaking. They said themselves that they had been obliged to hold their hands—that they could not increase their stock of meters. His learned friend had said that he was not going to ask for anything in regard to prospective increase. He was perfectly right, for he could not ask for it under the Act of Parliament. But a great deal of the evidence that had been given to swell this claim to the exorbitant figure of £38,000 had had to do with prospective increase. This was a thing the Court had absolutely nothing to do with. They had to see how far they were secure, and how far they could keep up the income. If he were to deal with such an item as £38,000, a very simple sum in arithmetic would show what a monstrous amount the shareholders would gain if the arbitrators awarded such a figure.

The UMPIRE: You know £5000 or £6000 comes off it with regard to deducting the interest.

Mr. TALBOT contended that one of the first things an Arbitrator should satisfy himself upon was that when, upon the transference of an undertaking, the shareholders got the money, they should not be in the position of being able to go into the market and at once very nearly double their incomes. This was a Company who were charging, and had charged for a great number of years with much steadiness, a remarkably high price for their gas, and a price which, it was obvious from the accounts, had not stimulated the consumption of gas in their district. It was a price, moreover, within a penny of their standard. The estimate that had been given on their behalf was an inflation of the value of the undertaking. His clients did not desire, on the one hand, to give the Company less than they were entitled to; but, on the other hand, they asked that the shareholders should not be entitled to make money out of the transaction because they happened to have been bought by the Local Authority.

Mr. WEDDERBURN said he would at once proceed to the two valuations before them. He had hoped that they would have been able to get through these arbitration proceedings without it being said that the Company were exorbitant in their claim, and that there had been inflation of the value of the undertaking. Everybody who was acquainted with the district knew of its growth; and if they went to Chorley Wood and saw the rising colony there, they would not want to see any more. The figures given of rateable values and of the production of gas were, to his mind, conclusive. No one could really think that the Company's position was not a rising one. After the agreed items, they had got at the start in regard to the valuations the sum of £1269 15s. 5d.; and after the deductions alluded to, he arrived at a net figure of £1032 15s. 5d. The next question was by what number of years to multiply this. He must say he thought it was as useless as it was unusual to look at the ultimate result and argue back from that. The only safe thing was to go on the recognized principle of what was the income and what was the security. It was not a question at all, as Mr. Talbot had urged, of a shareholder getting too much and investing his money well. To say that because there was a chance of a shareholder speculating well with the money he received, he should therefore receive less, was as wrong as to say that a company situated under these circumstances were to have less for the transfer of their undertaking because the local authority might have some difficulty in raising the money. The real question was what the Company were entitled to get and what the Local Authority were entitled to pay. The only safe course was the recognized one—namely, to rest on the usual questions of income, and could the Company have maintained it; was their business falling or rising? He asserted that it was clearly rising, and that the 1902 income could have been maintained. As to the price of gas being high, it was equally high in other cases. The income was secure in the hands of the Company; and with what the Council did with it he had nothing to do. Another question that had been raised was as to the arrival of electricity. But there was no evidence of anybody bringing electricity for many years to come; and he thought it only fair to say that the majority of the houses at Chorley were not such as would require the electric light. Besides, there was nothing to show that the powers as regarded electricity would be in the hands of the Local Authority. The suggestion seemed to him to be too speculative to enter into their minds in assessing the value of the undertaking. There was no claim here for back-dividends or for future profits. If they had chosen to inflate the claim, they might have asked for back-dividends. This showed that unreasonable inflation had not influenced them. As to the number of years, one thing had always been recognized—that a statutory company was entitled to a greater number of years' purchase than a non-statutory concern. A company clothed by Parliament was under the protection of Parliament; whereas a non-statutory company was not.

The UMPIRE: Shareholders in these cases have to find a new investment for their money; and I think the first thing necessary is to give them such a price as would enable them to find an equally good investment without loss. Now if the price of gas stock is lower than it was five or six years ago, would this difference make any difference in the number of years' purchase to be allowed?

Mr. WEDDERBURN thought not. The simple question was: What was the income, and could they go on maintaining it?

The UMPIRE mentioned that in a certain arbitration Mr. Shiress Will had said that the principle ought to be to give shareholders such a price as would enable them to secure as good an income as they had been getting.

Mr. WEDDERBURN declared that people ought to have a perfectly free hand as to their investments. The simple question was how much was the income, and was it secure. As to what they were going to do with the money, or what the state of the Money Market was, they had nothing whatever to do. He could not think that if, on the facts, a Court arrived at a decision, it would be a fair thing to say that, under certain circumstances, they might be able so to invest it as to considerably improve their income. It seemed to him that one could not go outside the ordinary rule, that for a statutory company 28½ years was not too high; and he stood on that. In the case of statutory companies, 28½ years had been usual, and this, as compared with 33 or 36, which was absolute security, was a reduction which allowed for the chances that beset one. If that was so, the way in which his figures now worked out was £1032 multiplied by 28½, giving £29,412. To this he thought they must add £137 for fittings before they put on the 10 per cent., because the Act said so. There was one other matter which he took to be admitted, because it was given in evidence by Mr. Corbet Woodall and had not been criticised at all, and that was the amount claimed by them for surplus works, £1190.

Mr. THOMAS said it must not be taken that this was admitted. Their view was that there were no surplus works.

Mr. WEDDERBURN said Mr. Woodall had not been cross-examined on this point at all; the Council's expert, Mr. Jones, had not dealt with it in any way; and Mr. Talbot had not attacked it. He was therefore entitled to say that it was admitted. He asked that this item should be added.

Mr. THOMAS said it was asserted that the works were below the necessary standard for the business the Company were doing.

Mr. WEDDERBURN, in conclusion, stated that the total amount he asked for was £33,440.

This concluded the proceedings; and the Court reserved their award.

ROYAL COMMISSION ON COAL SUPPLIES.

Evidence Bearing upon the Gas Industry.

(*Continued from p.* 174.)

A very interesting statement was put in on the fifteenth day (Jan. 28, 1903) by

Mr. GEORGE T. BEILBY.

Witness explained that he had been for a long time associated with chemical and other industries in which large quantities of coal are consumed for the production of heat and power, and had given a good deal of attention to the subject in its larger aspects as a national question. He had attempted to collect information as to the quantity of coal consumed in various departments of industry. No official statistics existed at the time to which he was referring; and therefore it was necessary to procure information from many sources. His figures were originally compiled as for the year 1898; and they were first published in his address as President of the Society of Chemical Industry in July of the following year. For the purposes of the present inquiry, they had, as far as possible, been brought up to date. Taking the coal output of the United Kingdom at the round figure of 220 million tons, and the exports at 60 millions, there remained for home consumption 160 million tons. Of this, it was estimated that about 78 million tons were consumed for the production of power and 46 million tons for the production of heat for industrial purposes, while 36 million tons were consumed for producing heat for domestic purposes. Taking the first two items more in detail, it was estimated that for the production of power railways consume from 12 to 14 million tons, coasting steamers from 6 to 8 millions, factories from 40 to 45 millions, and mines from 10 to 12 millions. In the production of heat for industrial purposes, blast-furnaces consume from 16 to 18 million tons, steel and iron works from 10 to 12 millions, other metals from 1 to 2 millions, chemical, glass, potteries, and cement from 4 to 6 millions, and gas works from 14 to 15 millions. In considering these figures from the point of view of probable economies, witness said certain items might be eliminated as being too far outside the scope of economies already known and proved. In this class might be placed railways and coasting steamers, to which might be added gas-works, which were already very economical consumers of fuel. The united figure was from 32 to 37 millions, and, deducting the larger figure from the 124 million tons of coal used for industrial purposes, a total of 87 million tons was arrived at as the item on which future economies would take most effect. Splitting up this figure again, the consumption for power production at mines and factories was found to be 52 millions, and for heat production 35 million tons.

In considering this item of consumption of coal for power production, witness said it was necessary to make some estimate of the work actually being done, and generally to consider in what way the coal was being consumed. Broadly speaking, the 52 million tons were being consumed in steam-boilers, and were converted into power by steam-engines. These installations were of all sorts of designs—good, bad, and indifferent—and were working with every degree of efficiency or inefficiency. For convenience they might be divided into three classes: The large and economical, the moderate-sized and fairly economical, and the small and wasteful. Even in the first class there was not a uniformly high standard of efficiency. The consumption of average coal per horse-power-hour would range from 2 to 4 lbs.—3 lbs. might be taken as a fair average. In the second class might be included non-condensing engines, simple and compound, the consumption in which would range from 4 to 6 lbs. per horse-power-hour—5 lbs. might be taken as an average. The third class would include the small engines and steam-pumps planted all over factories and engineering shops, in which motive power was generated near the spot where it was required; steam being distributed by long ranges of pipes, or generated in small imperfect boilers scattered over the works. The consumption of this class of engine might easily amount to 16 lbs. per horse-power-hour; and was not likely to be less than 8 lbs. An average of 10 lbs. would certainly be well within the mark. For the three classes, witness said he had taken as the average figures 3 lbs., 5 lbs., and 10 lbs. It was quite possible to know what proportion these three classes bore to each other; probably the second was responsible for the largest part of the consumption. He therefore took 5 lbs. as the average for all classes, though this was not the arithmetical mean of all the figures. By dividing the total figure of 52 million tons by the hourly consumption, an estimate of the whole horse power in use in Great Britain was arrived at; and it was equal to 5,320,000 indicated horse power per annum for 12 hours a day.

Witness then passed on to consider the relative efficiency of various forms of heat-engines. On this subject he made the following remarks: There are really two efficiencies to be considered as between the fuel

and the mechanical work which it is used to generate. There is the extent of the opportunity afforded by the temperature which is imparted to the steam or other working substance, and there is the capacity of the engine to take advantage of this opportunity. The increased efficiency of the modern steam-engine depends on two developments which have gone on side by side—the increased range of temperature got by means of higher steam pressure, and the more perfect use of the fall of temperature by the expansion of the steam in two or three successive cylinders. The higher temperature supplied the opportunity for greater efficiency, and the triple expansion made use of the opportunity. By still further raising the pressure of the steam, opportunity would be afforded for higher expansion in the cylinder; but it is doubtful if there is likely to be much further progress in boilers and engines of the present types. Important results in increased efficiency have been obtained by superheating the steam on its way to the cylinder. The steam consumption in these engines has been in some cases reduced to 12 lbs. per hour, or even less, which is equal to about 1½ lbs. of coal per horse-power-hour. By superheating, therefore, there is the possibility of reducing the coal consumption of comparatively small engines to that of the best and largest engines working without superheating. Whatever success may attend the development of superheating in steam-engine practice will make for economy in the national coal bill for power generation; but it is not likely to be one of the really large influences in this direction. The steam-turbine, in its present form, is chiefly an improvement of the mechanical side of the steam-engine. The designing of a gas-turbine does not appear to me to be an impossible problem, and it is highly probable that it will be attacked before long. The construction of an efficient gas-turbine would at once enable gas generation to take the place of steam-boilers for marine propulsion.

Reference to the gas-turbine led witness on to the subject of gas-engines, in regard to which he said: So far as gas-engines have been developed, they are still too bulky and unmanageable for use for naval and marine purposes; but the perfectly successful adaptation of its near relative, the oil-engine, to the driving of motor cars, shows that there are no insuperable difficulties in the way of producing compact and manageable gas engines. The gas engine is now firmly established as the most economical of heat motors. Its general efficiency is due to the high temperature limit which is reached by burning the fuel directly in the cylinder. This efficiency ought therefore to be principally credited, not to the engine, but to the "opportunity" which is supplied by the form in which the fuel is presented. The significance of this fact in connection with the present inquiry is, that there still remains a very large field for the attainment of increased efficiency in the gas-engine itself, both thermally and mechanically. The position of the engine to-day may be compared with that of the steam-engine in the early days of compounding. When the gas-engine has arrived at the stage corresponding with that at which the steam-engine has now arrived, the economical results will be correspondingly greater. While the gas engine was restricted to ordinary illuminating gas as its fuel, the conditions under which it could be used were rather limited; but even under these there has been, and will continue to be, a considerable replacement of small steam-engines by gas-engines. I might add on this point that I believe an estimate has been made that already there are in use small gas-engines amounting to a horse power of about 500,000, in the form of engines mainly using town gas.

Passing from the engine to the fuel driving it, Mr. Beilby said: A very great step forward was made when Mr. Emerson Dowson succeeded in applying fuel gas made from coke or anthracite to the ordinary gas-engine. A new impetus was given to the use of gas for the generation of power, and engines of considerable size were built to run with this poorer kind of gas. The heating value of illuminating gas is upwards of 600 B.T.U. per cubic foot; that of Dowson gas about 150 B.T.U. After it had been amply proved that gas of this low value could be used in gas-engines with efficiency and economy, it was only natural that the owners of blast-furnaces should try whether the still poorer waste gases from their furnaces were available for this purpose. These trials were completely successful. Simultaneously with, or following closely on, the application of producer gas made from coke or anthracite to gas-engines, gas made from ordinary bituminous slack in the producers of Mr. Wilson, Dr. Mond, Mr. Duff, and other inventors, was specially purified and tried for the same purpose. This step also was thoroughly successful. The influence of this new departure on the coal consumption of the country cannot fail to be enormous. If the average steam-engine and boiler installation of to-day, with its minimum average consumption of 5 lbs. of coal per horse-power-hour, were replaced by gas-producers and gas-engines, the 52 million tons of coal consumed for power purposes would be reduced to somewhere about 11 millions.

Coming to the question of the consumption of coal for the production of heat, witness said this was necessarily more complex, as the methods and the purposes of the application were so varied. The figure of 35 million tons, which was arrived at by deducting the gas-works consumption from the total of 46 million used for industrial purposes, was mainly consumed in the iron and steel industries; blast-furnaces employing 16 to 18 millions, and steel and iron works 10 to 12 millions. By the use of recovery ovens in the manufacture of the coke for blast-furnaces, a larger proportion of the heating value of the original coal would be made available in the form of tar and gas. If the gases from blast-furnaces were used directly in gas-engines, instead of being burned under steam-boilers, more than half of what was at present consumed would be set free for other purposes. The distribution of energy in the form of a current of high-potential electricity might be economically possible from blast-furnaces as centres of power; and the energy generated might replace what is at present produced by the direct consumption of coal. At a moderate estimate, from 2 to 3 million tons of coal might be saved in this way. The conclusion to be drawn from a general survey of the present practice in the generation and use of heat from coal was, that while there is ample room for economy in many directions, there is no outstanding opportunity such as is found in the production of power. The future developments of production in industry up to a very considerable amount might, however, in witness's opinion, be readily met by economies in coal consumption, without any serious increase of the fuel bill.

Witness then proceeded to indicate the economies which might be effected in preparing coal for sale or use. In this connection, he touched upon the subjects of briquette making, coke production, the recovery of residuals, and the Dellwik, Young and Beilby, and Mond systems of making gas. He concluded by offering the following suggestions: Clear, simple statistics might be published and brought expressly under the notice of the users of heat and power. These statistics should show the present state of consumption and the economic improvements which have been effected, and which are in process of development, as well as the cost involved in the replacement of old appliances by new. This statement would need to be issued by a committee of experts, in order to avoid any appearance of partiality. The subject of fuel and combustion should be recommended to our Universities and Colleges as worthy of special teaching, study, and research. It is one of the most important branches of industry, and provides a splendidly wide field for study and invention.

The witness was questioned upon the various points of his statement. In the course of his examination, his attention was specially directed by Sir George Armytage to the subject of the economy of fuel, and he was asked whether he had formed any general idea in regard to the saving which might be effected by distributing electrical energy from a centre. Mr. Beilby replied that he had looked into the matter a good deal, and he thought the chief economy would certainly be to the small consumer, who would be put into the position of the economically large working units, and at all events have part of the benefit. He looked forward to the replacement in this way of a large number of the very inefficient steam installations at present in existence—to the time, indeed, when the small steam-engine would be a thing of the past. Witness was further questioned upon this point as follows:—

Sir G. ARMYTAGE: Do you think that will benefit the small steam-engine man more than it will the people who have larger appliances?

Witness: The people who have the larger consumption of power will naturally prefer to get the whole benefit for themselves by manufacturing their own electric energy.

Yes; but do you think the smaller men will get a bigger benefit than they would by sharing in a still larger concern? I mean the theory of these large companies, which are to take hold of the whole county, is that, by having this large installation in one or two or three places quite close to the coal pits, they will be able to supply electric energy cheaper than people can make it for themselves. I wanted to ask you whether you had really worked that out at all?—I should think that economy would not be felt by a really large consumer. By "large consumer," I mean a consumer of a good many thousands of horse power. I think he will always be able to get more benefit by establishing his own installation.

Do you happen to know what is the cheapest rate at which electric energy is produced now in the kingdom?—I think by means of steam-engines it is very difficult to get the cost below £7 or £8 per electrical horse-power-year. I happen to be associated with one large electrolytic works in which 6000 or 7000 horse power is generated at the present moment; and during the last few years it has not been possible to get the cost much below £8 per electrical horse-power-year, and that is with a load-factor of 100 per cent.

Mr. J. S. DIXON: What is that per Board of Trade unit?

Witness: An electrical horse power is about three-quarters of a Board of Trade unit.

Mr. BRIGGS: You may say about £10 per Board of Trade unit?

Witness: Yes; I should consider that a very cheap cost price with average coal prices for steam-produced electricity under favourable conditions.

The CHAIRMAN: How much is that?

Witness: About £10 or £11 per Board of Trade unit per annum. I know that statements of very much lower amounts are put forward with regard to the cost; but I rather doubt, if these were worked out in a businesslike way, whether they would show that.

Electricity is produced at ½d. per Board of Trade unit at present, is it not?—Yes. It can now be produced at about ½d. per unit by steam; but we hope, by the introduction of the recovery producer and the large gas-engine, to reduce it to about $\frac{1}{10}$d.—that is to say, to bring it down to about one-third of the present cost. In such case we shall be in a position in this country to have our electrical energy at a price which is substantially less than that available at Niagara or Rheinfelden. At Niagara, the cost of electrical energy is about £4 per electrical horse-power-year, and at Rheinfelden it is about £6, with continuous working.

Mr. Beilby was also asked if he had formed any opinion, with regard to the distribution of (say) Mond gas, from some large central establishment, as to whether it would be cheaper to turn the power at once into electricity on the spot or to attempt a large distribution of the gas. He said he should think the distribution of the electricity would be more satisfactory in anything like a widely spread distribution. It would be very much more manageable. He added that he should think for a long distance it would probably be very much cheaper than the large gas-mains, though he was not a sufficiently practical electrician to say. His personal opinion was that this was the most hopeful way of Mond gas becoming useful for very many industries—say, a number of small industries generally.

In connection with this portion of his examination, Mr. Beilby subsequently sent in a statement giving the cost of fuel per unit of electricity sold; the figures being averages taken from 167 central stations, worked by steam-power in the United Kingdom. They were as follows:—

Limited Companies (1900-02).

15 Metropolitan stations	. . . . .	1·032d. per unit.
37 Provincial ,,	. . . . .	1·083d. ,,

Local Authorities (1900-02).

7 Metropolitan stations	. . . . .	1·076d. per unit.
108 Provincial ,,	. . . . .	0·886d. ,,

The average for the 167 stations was 0·952d. per unit, or equivalent to about 0·809d. per unit generated. Mr. Beilby compared this with the actual cost for Mond gas of 0·048d. per unit generated with gas-engines

running continuously at Winnington. He also submitted the following table in regard to coal consumption and economy:—

—	Consumption in Millions of Tons.	Saving in Millions of Tons.	Means of Economy.
Railways	12 to 14	5 to 7	Gas generators and engines, electro motors, and electro traction
Steamers	6 ,, 8	..	
Factories	40 ,, 45	20 to 30	
Mines	10 ,, 12	5 ,, 7	
Blast-furnaces	16 ,, 18	2 ,, 3	Gas-engines and recovery ovens.
Iron and steel	10 ,, 12	2 ,, 3	
Other metals	1 ,, 2	..	
Brick-works, &c.	4 ,, 6	1 to 2	Gas generators and coke.
Glass-works, &c.			
Gas-works	14 ,, 15	5 ,, 8	Gas cooking and heating, briquettes, and coke.
Domestic fires	30 ,, 36		
	143 ,, 168	40 ,, 60	

He said the chief difficulties which stood in the way of the rapid and extensive adoption of these economies were, in the first place, the natural inertia of individuals and corporations, and, secondly, the large capital expenditure involved in their adoption. He thought the inertia might be overcome by one or other of the following motives: (1) The fear of incurring heavy losses under existing conditions; (2) the hope of making larger profits under new conditions; and (3) the influence of example—new ideas being contageous in industry as in other departments of human interest. With regard to economy in the domestic consumption of coal, Mr. Beilby said it was to be expected mainly through the increasing adoption of central heating in houses; the open fire, or its substitute, the radiating gas-fire, being merely used as supplementary to the general warming by hot-water pipes or by stoves. A powerful impetus would be given to reform in domestic heating if judicious legislative pressure could be brought to bear upon the producers of black smoke. The architect, the builder, and the householder must be forced to realize that this is a question they must deal with. The cheapening of town gas and the preparation of really good briquettes for domestic stoves and fires would greatly facilitate the necessary reform. In conclusion, he said he was convinced that the industry of the country, its transport service, and its domestic life, might all be carried on in a more perfect and efficient way, and with greater comfort and seemliness, with a coal consumption of less than two-thirds of the present amount, and he was satisfied that no real financial barrier stood in the way of this result being attained.

At the close of Mr. Beilby's examination, evidence was given by Colonel S. A. Sadler, M.P.

Being a colliery owner, witness's statement dealt mainly with Middlesbrough and Durham. On the subject of the manufacture of coke, he said the annual production for metallurgical uses in the latter county and Northumberland and on the Teesside was about 5 million tons. It was claimed that the old-fashioned beehive ovens gave the hardest, brightest, and most refractory coke. Great economy was effected by employing the hot gases from the ovens for steam raising. Nearly all large coking collieries availed themselves of this important advantage. A battery of about 35 ovens would provide sufficient heat for a Lancashire boiler 30 ft. by 8 ft. Each pound of coal put into the ovens would evaporate about 1·2 lbs. of water; but, of course, this would depend on the percentage of the volatile matter in the coal. The quantity might vary; but average ordinary Durham coking coal could be taken to give this result. The coking quality of the coal had a marked influence on the quantity of breeze or "ballast" which invariably accompanied the operation. The ballast was an excellent substitute for sand in mortar, concrete, &c. From its lightness and absolute chemical permanence, no other material could compare with it for the purpose.

Coming to the subject of the recovery of the bye-products, witness said there were several systems of coke-ovens which allowed of this being done. The first installation of ovens on this principle in England was made by MM. Simon-Carvès, the inventors. This method of coking was, in his opinion, likely to supersede all others, and play an important part in cheapening the cost of iron and other manufactures where coke forms an integral part. The quantities of bye-products obtained fluctuated with the constitution of the coal, and they were, moreover, influenced by the heats and practice at the ovens. If the ovens were worked with some little exhaust on them, any air admitted would attack the products first, and partially destroy them. This accounted for the very marked variation in the production from this class of oven. Witness went on to say that he made 2000 tons of coke a week at one of his collieries, and the average yield was 26 lbs. of sulphate of ammonia per ton of coal. Taking them at a very low yield per ton, the figures, which were the net value after deducting all costs, were as follows:—

20 lbs. of sulphate of ammonia	1s.	8d.
6 gallons of tar	0	9
1 gallon of benzol	0	4
35 per cent. surplus gas (say 2000 cubic feet)	0	6
10 to 15 per cent. more coke, say	1	6
Total gained by retort coking	4s.	9d.

"These," said Colonel Sadler, "are eloquent figures, and comment seems superfluous. It is appalling to contemplate the loss the country is sustaining by wasteful coking processes. It is, indeed, nothing short of a national reproach. Taking Durham and Northumberland alone, together they make every year (say) 5 million tons of coke. Admitting the minimum increase of yield by retort-ovens at 10 per cent., that means 500,000 tons of coke at 14s. per ton, or a loss of £350,000. I have put it at 1s. less than beehive coke so as to be well within the mark—14s. per ton, or a loss of £350,000. If we add to this the value of the bye-products—viz., 3s. 3d. per ton on the 6,660,000 tons of coal required to make 5 million tons of coke—roundly £1,100,000, we get a total of £1,450,000 a year, which the two counties would save were all the coke produced in retort-ovens. Assuming that about 10 tons of oven coke are produced annually in Great Britain, the national saving would be £2,900,000."

Witness closed his statement with a few remarks on processes for making coke out of coal which is usually considered to be non-coking, and on the manufacture of briquettes—a subject which had been dwelt upon by the preceding witness. He said that though several factories had been established, the manufacture of briquettes had not flourished in the North-East of England. Several causes had probably contributed to bring this about. In the first place, there were the facilities for shipping small coal to the Continent, where briquettes were made on close scientific lines; next, the large use of small coal for coking, and the rather considerable market for it for fuel for salt and chemical works, but especially for calcining iron ores and limestone; and, lastly, the comparatively low price at the North-East ports of screened coal, with which, of course, briquettes had to compete. The last cause, perhaps, was more important than the others. Questioned upon this subject, Colonel Sadler said his opinion was that small coal, no matter whether it was "dry" or "fat," could be utilized to advantage for coking or briquette making. It was pointed out to him that in South Wales they "gob" a large percentage of the coal won; and he was asked whether, if all that coal were brought out instead of being gobbed, he thought, from experience, it could be utilized to advantage either for the making of briquettes or for coking purposes. Witness said he should think it could, assuming that the coal was good. The gobbing of so much coal was, to his mind, a national waste. There was no such thing as this known in the North of England, where not a particle of coal was not utilized in some form or another. He was very much surprised to hear it was left behind—it was very astonishing. He supposed the explanation was that the South Wales market was for a large coal, and this was so much more profitable than the small that it was cheaper to leave it than to haul it out.

GAS AND ELECTRICITY IN MANCHESTER.

Reduction in the Price of Gas.

Last Wednesday, the Gas and Electricity Committees of the Manchester Corporation had before them the results of the working for the twelve months ended March 31, and the estimates for the current year.

The position of the gas undertaking will be gathered from the following figures, received from the Superintendent (Mr. Charles Nickson).

Year ending March 31, 1904.

	Estimated.	Actual.
Income	£721,000	£743,769
Expenditure	574,200	558,608
Gross profits	£146,800	£185,161
Interest and sinking fund	94,225	89,964
Net profits	£52,575	£95,197
Paid into city fund		70,000
Surplus		£25,197

Estimated net profits for the year ending March 31, 1905, after making a reduction of 2d. per 1000 cubic feet to the ordinary consumers—*i.e.*, from 2s. 6d. to 2s. 4d. per 1000 cubic feet within the city, and from 2s. 9d. to 2s. 7d. without—to take effect from June 24, 1904	£46,639
Proposed payment into the city fund for the year ending March 31, 1905	£50,000

In addition to this, the Committee estimate that they will be able to spend £13,660 on extension works for which they have no borrowing powers, and have a balance in hand of a little over £8000. The reduction of 2d. per 1000 cubic feet in price is to include the public lamps, thereby helping the city to the extent of £2500. The Committee, the Engineer (Mr. J. G. Newbigging), and the consumers, are alike to be congratulated on these figures. Without any alteration in the charge for gas, the Committee calculate that they would at the end of the year have a net profit of £73,639, apart from the surplus acquired during the past twelve months. No reduction is being made in the charge to prepayment consumers (which remains at 1d. for 30 cubic feet); and the price of gas for power purposes will also remain as it is—2s. per 1000 cubic feet. It may be pointed out that no charge is made for the hire of meters and stoves. The quality of the gas tested with a flat-flame burner is slightly under 18 candles; tested with the "London" argand it would be about 19 candles.

With regard to the electricity undertaking, a year ago a loss of £9450 was anticipated on the twelve months' working. The estimated income was £233,000, while the sum approximately received was £261,850; and instead of the loss looked forward to, there was, after meeting the expenditure, a transfer to renewals suspense account of £25,000. In the current year, the Committee estimate an income of £287,600, and hope the expenditure will again leave £25,000 to be transferred to the same account. Running charges in the year just closed showed marked economies, and fixed charges heavy increases. The running charges amounted to £53,196 for an output of 28,953,459 units, as compared with the previous year's total of £48,489 for 17,400,223 units—or 0·44d., as against 0·67d. per unit. Fixed charges amounted to £208,654; whereas for the previous year the corresponding total was £140,365. Among fixed charges was the provision of £25,000 for future renewals. The income during the past year from lighting and traction sales again showed steady growth. The receipts from lighting, at 5¾d. per unit, rose from £61,937 to £70,484—an increase of £8547, or 14 per cent.; lighting at 1¾d. per unit, *plus* fixed charge, from £63,885 to £75,973—an increase of £12,085, or 19 per cent.; and traction, from £52,463 to £100,000—an increase of £47,537, or 90 per cent.

PRIMITIVA GAS AND ELECTRIC LIGHTING COMPANY, LIMITED.

The Sale of the Electrical Undertaking.

The Annual General Meeting of this Company was held last Tuesday, at the London Offices, No. 2, Bank Buildings, Princes Street, E.C.—Mr. H. E. JONES in the chair.

The SECRETARY (Mr. J. H. Brouwer) read the notice convening the meeting; and the Directors' report and the accounts (which were noticed in the "JOURNAL" for the 12th inst.) were taken as read.

The CHAIRMAN first expressed the regret of himself and his fellow-Directors—which regret he was sure would be shared by all present—at the unexpected death of their colleague, Sir W. Fischer Agnew. The Board, he said, had anticipated what they knew would be the wish of the shareholders, and had sent a letter of condolence to the widow. Turning to the report, he said it gave such a clear account of the position of the Company's affairs that it relieved him of the necessity of troubling the shareholders very much upon them. The Directors, it would be seen, considered the profits of the year sufficient to recommend a considerable addition to the dividend on the ordinary stock—that was to say, 5 per cent., instead of the 3 per cent. paid last year, and no dividend at all the previous year, when they had a lot of expenses to meet incurred in taking over the old undertaking. Before arriving at this rather serious step of recommending such an important addition to the dividend—it was a 60 per cent. increase upon that paid last year—the Directors gave it long, careful, and anxious consideration. They were perfectly satisfied that the profits of the undertaking justified it, and indeed they would perhaps have justified a little more. But one swallow did not make a summer, and one good year did not make a sequence of good years. The policy the Directors had acted upon this and last year was that they should go very steadily and surely to work in this matter of adding to the dividend. While it was a very pleasant thing to come to the shareholders and tell them that their shares had earned another 2 per cent. in the past year, it was an extremely unpleasant, and to him revolting, thing to have to come to the shareholders and tell them that unfortunately they could not have the same amount of dividend as before, This was not the practice of any of the companies in which it was his fortune to be a shareholder; and as long as he had any control of the helm of this ship it would not be the policy of this Board. Nothing short of unforeseen disaster would bring the Directors to the shareholders with a story of that kind. It would be seen that, in addition to recommending the increased dividend, the large sum of £15,000 had been placed to reserve account; and £2500 had been written off towards amortization of the item "Discount on debentures, and expenses of issue." They had, of course, also provided £40,000 for the dividends on the preference stock. The year, as would be seen, had been a profitable one, inasmuch as the expenses of conducting the undertaking in Buenos Ayres had been less, and the income had been slightly more. Residuals, however, had not done so well; but this disadvantage was counterbalanced by the advantages in the economy of manufacture—their General Manager and his assistants having shown conspicuous ability in this matter. Under the head of improvements and extensions, £37,768 had been expended in connection with the gas and electrical departments, and this had come out of the funds of the Company. The stock, stores, and loose plant of the electrical department—amounting to £28,194—had been transferred from the Buenos Ayres books, in order to close the accounts of the department, owing to the handing over of the undertaking to the Deutsch Ueberseeische Electricitäts Gesellschaft. This was a Company of first-class standing and importance in Berlin for managing electricity supply; and they had become seated in Buenos Ayres with a valuable contract for supplying electricity not merely for lighting (which probably the shareholders were aware was a less profitable mode of supplying electricity than that of furnishing it for motive power), but for tramway purposes. Now the Primitiva Company were debarred from this. Their arrangements did not admit of their supplying the tramway service, nor were they linked or physically situated for the purpose. However, the Deutsch Company came to the Directors, and pointed out that they must necessarily become competitors, because there was no monopoly in this matter in Buenos Ayres. The Board saw they were going to be competed with by people manufacturing on a larger scale than themselves, and necessarily cheaper, because with a greater output their working expenses would be less; and they had beyond this the advantage in the competition that their engines and machinery were working all through the hours of daylight, while their own were standing still, and earning nothing. Therefore, inasmuch as the Deutsch Company proposed to give them an extremely fair bonus upon the capital expended in the electrical undertaking—a bonus of 50 per cent. in round figures—and inasmuch as they agreed to pay the principal and interest over a convenient number of years, and offered the Company the right, until the very last shilling was paid to cancel their indebtedness, to retain a lien on the property (so that if the Deutsch Company failed at any time the Primitiva Company could re-enter into possession of their property no matter how much they might have been paid upon account), the Directors came to the conclusion that this would not be a disadvantageous thing to do. First the transaction gave them a profit on their capital expenditure; and, secondly, it relieved them of rivalry and competition which would have been severe, and which might have led them to reduce their price for electricity to a point that would have interfered very much with the dividend. They also got rid of some items of depreciation which did not attach to gas, but which did attach to the supply of electricity, and which the Auditors had distinctly insisted upon in both the balance-sheets that had been issued before they got rid of the property. Though in their prosperity this would perhaps have been a simple matter, it would not have been in years of adversity and in competition, and it might have seriously interferred with the dividends earned by the Company. These were considerations the Directors could judge by their own business methods. But they were not satisfied with this, and they had the assistance of their colleague (Mr. C. H. Sanford) on the spot. He went into the whole matter in a most complete manner, and advised them as to what was actually the local position. In addition to this, the Board supplemented their information by a report from a leading electrical engineer in this country on how they would need to administer their undertaking in face of the strong competition, and what expenditure of capital might be necessary for any improvement he could point out. His report was such as to lead the Directors to believe that, before they could face competition on the best lines, they would have to spend more capital, and that that capital, saddled as it would be with depreciation, was something that they would have to think twice about. Under all these circumstances, the agreement for transfer was entered into. But not satisfied with retaining a lien upon the property, the Directors sought to interfere somewhat in the way in which the Deutsch Company carried on the undertaking; and in deference to their views, the latter offered a seat on their Board to one of the members of the Primitiva Board. This had been taken; so that, being represented in the administration, they would receive reports as to how things were going on. In consequence of this arrangement, there were some items appearing in last year's balance-sheet—viz., £1175 on debenture sinking fund account and £8663 depreciation reserve account—relating to the electrical section which had been transferred to the general reserve account, having no longer the responsibility of this depreciation. The account had also been credited with £2450 interest accrued on debentures at present unissued; making, with the £15,000 placed to the account, a total at its credit of £37,288. The Chairman concluded by proposing the adoption of the report and balance-sheet, and the declaration of the dividend.

Mr. J. KINCAID seconded the motion, which, after one suggestion as to hastening the wiping off of the item of discount on debentures and expenses of issue, was unanimously adopted.

On the motion of Mr. HEALD, seconded by Mr. RYDER, the services of the Chairman and Directors and of the officers and staffs at home and abroad were appropriately acknowledged.

In this connection, the CHAIRMAN mentioned that the whole of their leading officers had received recognition, in the way of bonuses, of the successful issue of the year's work. The announcement was received with gratification by the shareholders.

HUDDERSFIELD GAS AND WATER SUPPLY.

The Estimates for 1904-5.

At the Meeting of the Huddersfield Corporation last Wednesday, the estimates recommended by the various Committees for laying a borough rate for the year ending March 31, 1905, were under consideration. The revenue account of the gas-works fund for the past financial year contained the following items of income: Gas-rents, £75,932; meter-rents, £2686; coke, £9796; tar, £5093; ammoniacal liquor, £2612; sulphate of ammonia, £3788; spent oxide, old materials, and fitting trade, £889—total, £100,796. Against this the expenditure was: Carbonization, £34,810; purification, £3049; maintenance of works, £6888; distribution, £10,119; rents, rates, and taxes, £6616; prepayment meters and stoves, £4000; salaries, £2495; bad debts, discounts, &c., making up a total of £72,458. Adding the interest and sinking fund, £13,725, brought this up to £86,183, and left a surplus of £14,613, which has been appropriated as follows: An amount equal to 2 per cent. on the capital outlay of the undertaking has been carried to a depreciation and contingencies account; and the balance of £8160 11s. 2d. applied towards the liquidation of the reconstruction of works account, which stood at £25,099 at the close of the financial year. The remaining balance on this account is now £16,993. The following comparative statement of coal carbonized and gas consumed was submitted by the Engineer and Manager (Mr. E. A. Harman).

	Year ended March 31, 1903.	Year ended March 31, 1904
	Tons. Cwt. Qrs.	Tons. Cwt. Qrs.
Coal carbonized	62,140 14 1	62,753 10 2
Oil used	256 0 0	nil.
Cubic feet of gas supplied—		
Lighting	266,277,400 at 2s. 9d.	253,680,800 at 2s. 9d.
Stoves and power	147,663,500 ,, 2s. 3d.	163,225,800 ,, 2s. 3d.
Prepayment meters	90,986,600 ,, 2s. 9½d.	111,699,500 ,, 2s. 9½d.
Public and private lamps	55,666,158	55,283,190
Contracts and Market Hall	640,800	633,300
Special supply for balloons, illuminations, &c.	1,200,000	nil.
Totals	562,434,458	584,522,600

Alderman JESSOP having moved the adoption of the minutes of the Gas Committee,

Mr. WOOLVEN called the attention of the Chairman to the price of gas for heating purposes. He said 3d. per 1000 cubic feet had been put on a few years ago in consequence of the high price of coal. Now coal was cheaper; but the consumers of Corporation gas were paying the same as before. The price of gas for heating purposes supplied by the Corporation was the highest in the West Riding. He asked if there was any possibility of a reduction.

Alderman JESSOP said he could not hold out any hopes of reducing the price until the suspense accounts were cleared off. He mentioned that the increased consumption of gas for motive power had been something like 22 million cubic feet. When they got rid of the old back debts, they would be able to reduce the charges.

The Water Committee asked for a rate of 7d. in the pound. This will balance the deficiency on revenue account of £6925 15s. 7d., and add £5495 17s. 11d. to the contingencies and depreciation fund. This fund will then only amount to £1742 12s. 1d.—an insignificant sum for an undertaking with a capital outlay of upwards of £1,600,000. The deficiency on the revenue is mainly due to the further Brow Grains Dyke compensation claims and costs, £1455 5s.; costs in connection with the opposition to the Oldham Water Bill, £530 17s. 6d.; and increased interest and sinking fund charges. There was an increase for the past year of about £1000 in domestic water supplies.

MACCLESFIELD CORPORATION GAS SUPPLY.

The Past Year's Working.

The Gas Committee of the Macclesfield Corporation and their Engineer (Mr. E. L. Newbigging) are to be congratulated on the result of the past year's working of the gas undertaking; the profit made having been the largest on record. This time last year, the amount was £5599 16s. 2d.; but this sum is now exceeded by £9·5 2s. 4d. By the vote of the Council at their last meeting, £1500 is to be transferred to the maintenance fund, and the remainder—£5004 18s. 6d.—will go in relief of the rates. This handsome contribution is equivalent to 1s. 1d. in the pound, or 1d. more than last year, when only £1000 went to the maintenance fund. Mr. Newbigging has sent to a local paper the following details: The gross profits amounted to £10,539 14s. 10d.; but interest and sinking fund charges (£4034 16s. 4d.) bring this down to the amount of the net profit stated above. The total consumption of gas during the year was 171,361,120 cubic feet, compared with 163,891,877 cubic feet in the preceding twelve months; being an increase of 0·865 per cent. The quantity of gas supplied through prepayment meters rose from 25,286,194 to 26,395,336 cubic feet; and the ordinary meter consumption also shows an increase of upwards of 500,000 cubic feet. In the manufacture of gas, 15,760 tons of coal and 2200 tons of cannel were used; the average number of cubic feet made per ton being 11,296, compared with 11,207 in the year 1902-3. For the gas used for street lighting purposes, the bare cost of production only is charged; and the Lighting Committee will be called upon to pay 1s. 6½d. per 1000 feet. It is expected that in Mr. Newbigging's report on the current year's working some interesting comparisons will be possible between the quantity of gas consumed for lighting and power purposes, as separate records are now being taken of each, on account of a slight reduction in the price charged for the latter.

RIPON CORPORATION GAS SUPPLY.

A Welcome Decrease.

The total output of the Ripon Corporation Gas-Works during the twelve months to March 31 amounted to 36,440,806 cubic feet, as compared with 39,284,220 feet in the previous year—showing a decrease of 7·23 per cent. The Engineer and Manager (Mr. W. T. Lancaster), in his annual report, remarks that to have such a falling off looks as if the use of gas was decreasing; but an examination of the figures would show that more gas had been sold and accounted for last year than in 1902-3. The explanation of the matter is the reduction of the leakage, which has been brought down from 14·72 per cent. to 4·96 per cent., resulting in a saving of close upon 4 million cubic feet of gas. Under these circumstances, the amount sold per ton of coal carbonized, of course, shows considerable improvement; the figure being 10,043 cubic feet, against 8188 feet. There is also an increase in the make per ton, which was 10,561 feet last year, as compared with 10,341 feet in 1902-3. The gas was consumed in the following manner: Ordinary meters, 28,228,850 feet; slot meters, 3,989,280 feet; public lamps (per meter), 1,829,219 feet; public buildings and private lamps, 286,350 feet; and used on works, &c., 299,100 feet. The amount owing to the bank on March 31 last year was £5194; but it has now been reduced to £3948, in spite of the fact that 5d. per 1000 cubic feet has been taken off the price of gas. Mr. Lancaster and his Committee have good cause for satisfaction in the results achieved by the past twelve months' operations of the undertaking of which they have charge.

NEW GAS-WORKS FOR SILSDEN.

It is expected that, as from the 1st prox., he inhabitants of Silsden, in the West Riding of Yorkshire, will be supplied with gas from works owned by the Urban District Council. The history of the gas supply of this little town is rather interesting. Originally it was furnished from the private works of a local firm; and the arrangement continued till about 25 years ago, when the Local Board entered into an agreement for 14 years with the Kildwick Parish Gas Company for a supply of gas in bulk. About three years before the expiration of the term, the Local Board considered the advisability of erecting works of their own. It was, however, deemed inexpedient to do so; and thereupon the old agreement was cancelled, and another made for 14 years. This expired at the close of last year; but before then the old idea of having gas-works for the town was revived, and the project adopted. For the convenience of all parties, however, the agreement was allowed to remain in force till the 30th inst, by which date it was thought the new works would be ready. When the Council first decided to erect them, they consulted Mr. E. A. Harman, the Gas Engineer of the Huddersfield Corporation, who prepared plans and specifications for works capable of manufacturing 10 million cubic feet of gas per annum. Taking into consideration, however, that during the past few years the Kildwick Gas Company have supplied Silsden with between 9 and 10 million cubic feet, it was thought advisable to increase the capacity; and now it is estimated that 12 million cubic feet can be produced yearly. The estimate of the cost of the works was £6700; but the increase in their capacity has entailed further outlay, while other incidental expenses have made it necessary for the Council to apply to the Local Government Board for permission to borrow another £2200.

The erection of the works, which are situated on the banks of the Leeds and Liverpool Canal, was entrusted to Messrs. Clapham Bros., Limited, of Keighley, who have made excellent progress with them. The retort-house and coal-store are in one building, which is constructed of limestone, with steel roof; and the coal-store is immediately adjacent to the canal, so that the coal can be tipped direct from the boats on to the floor of the store below. There are four settings of retorts, on the regenerative principle, each having five mouthpieces, and there is room for a fifth. By means of 8-inch pipes, the gas passes to the horizontal condensers, which are just outside the retort-house. Close by is the tar-well, into which the liquor runs from the condensers by gravitation. The tar is pumped, by means of an Evans pump, capable of dealing with 300 gallons per hour, into one of three compartments of a tank which is situated on the roof of the engine-house; one of the other two compartments being used for the storage of water and the other for liquor. In the engine-room is an 8-horse power steam-engine, capable of driving 5000 cubic feet of gas per hour through the exhauster, after leaving which it passes through a Livesey washer, which is placed at the bottom of the scrubber, the latter being 42 feet high and 5 feet in diameter. The purifying-house has three purifiers, each 10 feet square and 5 feet deep (with provision for a fourth), furnished with one of Weck's centre valves. The holder is of steel; and provision is made for telescoping it. The bell is 70 feet in diameter and 22 feet deep; and the crown 3 ft. 6 in. deep. It has a capacity of 84,000 cubic feet. The governor is one of Milne's. Should the works require extending at any time, there is ample room on the ground; and the plant has been so constructed as to permit of this being done with as little inconvenience as possible. The boiler in use is of the Cornish type, and has been supplied by Messrs. Clayton, Son, and Co., Limited, of Leeds. It is 10 feet long and 4 feet in diameter, and has been tested at 180 lbs. to the square inch, and with a working pressure of 80 lbs. The Council have secured as Manager Mr. H. M. Butterfield, late Assistant-Manager at the Bingley Gas-Works.

NEW GAS-WORKS AT SHOTTS (N.B.).

A boon has been conferred upon the district of Shotts (N.B.) by the erection of works by the Stane and Dykehead (Shotts) Gas Company, Limited, for the purpose of furnishing a gas supply to the inhabitants. The works were completed about two months ago; and to celebrate the event a dinner was held on Tuesday, the 12th inst., at the Station Hotel, Shotts, on the invitation of the Laird (Mr. Robert Forrest), the arrangements being carried out by the Secretary of the Company (Mr. Thomas Rae, of Wishaw). The undertaking has made a good start, for gas is being supplied at 4s. 6d. per 1000 cubic feet, which is a low price considering that so far there are only about fifty consumers, and that the consumption for the first year is estimated at no more than a million cubic feet. A beginning was made with the works early in November; and they were completed well within six months of the formation of the Company—only seven weeks being occupied by Messrs. J. Firth Blakeley and Co., of Dewsbury, in the erection of the apparatus. The site is adjacent to the railway; and though no siding is at present available, there is a gangway by which coals are run into the retort-house in tubs direct from the truck, so that no cartage is incurred. One great advantage is that the Company erected a large gasholder, of a capacity of 30,000 cubic feet; and though the output for the first two or three years will not be more than about 3 million cubic feet of gas annually, the works are built with a view to being able to supply 7 or 8 millions. The enterprise shown by the Directors of this Company might be followed with advantage in many urban districts which have as yet had no chance of becoming acquainted with the great benefits derivable from a supply of gas at a reasonable price.

THORIUM SUGGESTIONS.

Dr. T. Lamb Phipson wrote as follows to "The Standard" last week: It is surprising that no search is being made in Scotland or Wales for monazite sand, and for rocks containing the rare metals cerium, thorium, &c., the oxides of which are so valuable for the manufacture of incandescent gas-mantles. The rocks of Norway which contain these rare oxides have their representatives in many parts of the globe; and these interesting products are being sought for in many lands. But Great Britain and some of our Colonies, which contain rocks very similar to the Norwegian granites, are apparently being neglected in this respect. The sands of some streams in Canada and the United States prove remunerative if they contain from 4 to 7 per cent. of monazite. Some few years ago, I extracted these rare oxides from the granite kerbstones which were then being laid down in front of my house at Putney; and I believe that many varieties of granite rock will yield them. The main difficulty I met with was the pulverization of the rock before making the analysis, because if this operation is done in the ordinary iron mortar, it introduces so much iron into the sample that it entirely vitiates the results, unless this metal be extracted by means of a magnet before the analysis is made. In sand it is difficult to detect thorium minerals, even under the microscope. Nothing short of a careful analysis can put the rare oxides in evidence with certainty; but fortunately this is not a very expensive process. At present one ton of thorium minerals supplied annually from the South of Norway represents about £7000 sterling. Brown-coloured sands have been recently found in Nigeria; but the samples I have seen hitherto owe their brown colour chiefly to manganese oxide. There exist also brown-coloured sands—more or less resembling the monazite sand on the coast of Bahia (South America)—in the streams of Wales and Cornwall, which hitherto have only been examined for gold and tinstone. Monazite and thorite should be sought for also.

New Joint-Stock Company.—The Gas Power and Bye-Products Company was registered in Edinburgh last week. The objects of the Company are to acquire and develop processes for producing gas, electricity, fuel, sulphate of ammonia, naphtha, and other bye-products. The capital is £6000, in 1200 shares of £5 each. The public are not invited to subscribe.

NAVAL STRATEGY AND GAS LIGHTING.

Naval strategy and gas lighting seem widely different subjects of study. Yet we are made aware in the "Daily Express" for the 20th inst. that the plan adopted by Admiral Togo which led to the destruction of Admiral Makharoff's flag-ship and the loss of the gallant Commander-in-Chief was evolved by Mr. Scott-Snell, known to our readers as the inventor of the Scott-Snell lamp. We have been interested to learn that this is only one feature of a system devised by this gentleman, who at one time devoted his energies mainly to things electrical and marine.

The paragraph in the paper referred to gives a diagram and description of the strategy employed, and says:

The diagram gives an interesting idea of the ruse which Admiral Togo practised in the last engagement at Port Arthur. This ruse was devised by Mr. Scott-Snell, who was a member of the Thames Iron-Works Company when it built two of the Japanese ships which took part in this engagement —the *Shikishima* and the *Fuji*. Explained without technicalities, the ruse is as follows: The blockading fleet divides itself into two sections, which keep in touch by wireless telegraphy. The smaller section shows itself near the port, entices the enemy out, and then moves round in a circle, the enemy following. Meanwhile the larger section of the blockading fleet has circled round to the mouth of the port, where it is joined by the decoy section, which has been circling after it. The enemy, which has been pursuing an apparently weaker force, finds itself shut out of its harbour by a fleet of overwhelming strength.

The fact has been brought to knowledge that some of the most prominent men connected with naval and military matters in this country have interested themselves in these schemes of Mr. Scott-Snell; and had Great Britain, in place of her ally Japan, been at war, it is possible we should have heard more of this inventor in connection with warfare than in the peaceful pursuit of eclipsing electric arcs by adaptations of Welsbach's great discovery. It is pleasing to us to make this reference to the work of Mr. Scott-Snell, as one sometimes hears that the gas industry does not muster as many highly trained scientific minds as its rival industry electricity; but with the passing of the simple flat-flame burner, gas can and does find room for men of the most brainy character. Naturally in such a publication as this we have mainly to do with Mr. Scott-Snell's work in respect to gas lighting; but we find his labours in other spheres have been as prominent as in our own industry. He is the author of various papers upon his inventions in Australia as well as here in England. A paper by him on rapid cable laying for war purposes at the Royal United Service Institution contains matter which shows how deeply he has gone into questions of naval strategy; and a pamphlet he produced on this subject contains a forecast of the future of naval movements which the present war has unmistakably verified. In matters of Imperial interest, he is full of information; and one leaves him with the gratifying feeling that, in a quiet unobtrusive way, the great schemes of British preparation are going steadily onward.

MANCHESTER CORPORATION WATER SUPPLY.

A Heavy Deficiency.

The Water Committee of the Manchester Corporation had a meeting on Thursday, under the presidency of Alderman Sir J. J. Harwood, at which they considered and adopted their report for last year and their estimates for the current twelve months for presentation to the City Council. The year ending March 31 closed with a deficiency of £21,837, which has to be added to a deficiency at the corresponding date last year of £31,162; making a total of £52,999 Out of this amount, however, has to be reckoned £20,000 paid last year for interest and sinking fund upon the money expended on laying the second line of pipes from Thirlmere, which at present yields nothing to revenue. The estimate for the current year places the probable expenditure at £394,575, and the probable receipts at £315,000; so that the deficiency will probably be increased, by an addition of £26,576, to a total of £79,575. On capital account the estimated payments reach £428,430, of which £25,000 is for the extension of mains, £90,000 for the Thirlmere aqueduct second line of pipes, and the rest for mortgages and other charges becoming due. The receipts available for these purposes are set down at £172,276; leaving a balance of £256,154 to be provided for. The Committee recommend the Council to levy a domestic water-rate of 8d. in the pound and a public one of 1d. in the pound upon all property assessable thereto, for the purpose of raising the amount required for payment of the expenses connected with the supply of water within the city during the year commencing on the 1st inst.—these rates being the same as last year. The amount of estimated available rates outstanding on the 31st of March out of a gross sum of £50,000 was £24 4s. 6d.; and of rentals, £144 19s. 8d. out of a gross sum of £247,500.

Attempted Suicides by Gas.—A married woman named Alice Steele was, a few days ago, charged at the Bristol Police Court with attempting to commit suicide. She was found by a friend in bed with an india-rubber tube in her mouth; the other end being attached to the gas-burner, the tap of which was turned full on. Fortunately, the pipe was removed in time, and the woman recovered. The defendant's husband stated that she had given way to drink, which was the only cause he knew of for her conduct. The Magistrates advised her to take the pledge, which she consented to do; and she was then bound over for six months. At Halifax, an elderly labourer, named Joe Greenwood, attempted to commit suicide in the same manner; but fortunately the meter in the house was of the prepayment type, and the gas supply gave out before he had accomplished his purpose. When discovered by his wife, he was in a serious condition; and it was necessary to remove him to the infirmary. The Magistrates remanded him to permit of the state of his mind being inquired into.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A beginning was made with the formation of a Junior Gas Association for Scotland at the meeting held in Edinburgh last night, a report of which is given in another part of the "JOURNAL" to day. The proceedings were of a very preliminary order indeed; nothing being resolved upon except the appointment of a Secretary for the Edinburgh district. But from some of the remarks which were made, and the fact that the movement has had its initiation in Mr. H. O'Connor, it is evident that the intention is to form a body that will be more educative in its character than anything else—a sort of continuation class for workers in the gas industry. Only those behind the scenes know of the valuable work which Mr. O'Connor has been doing for the gas engineering profession during the past few years, in his classes in the Heriot-Watt College of Edinburgh. There are gas managers everywhere who have passed through his hands. In this Association these will find a bond of union which has not hitherto existed. But, of course, the movement is far wider, because there are other eminent teachers besides Mr. O'Connor; and the membership is not to be confined to those who have studied gas manufacture. If there was one thing which was emphasized more than another at the meeting it was the width of the scope of the new Association. All are to be welcome who are connected with gas manufacture or gas engineering. Nothing, it may be observed, was said regarding the financial side of gas undertakings, which is an important branch of a gas manager's training; but as the inclusion of this subject would open the door to collectors, surveyors, and clerks, it is probably considered that the objects of the Association would, in order to admit such a numerous class, be stretched to an extent that would interfere with its usefulness. There will, in truth, be plenty of scope for the Association without taking cognizance of office business. The work of education is a never-ending one, and there is, within the ring of a gas-works proper, sufficient to exercise the intellectual ingenuity of all the members, and the seniors who may come to their aid. The general unanimity of opinion at the meeting, and the success which is foreshadowed in the Glasgow district, bear evidence to the feeling that there is room for a Junior Association. It may be said that all that will be done could be accomplished by the juniors if they were to become associates of the North British Association. But this is only partially true, because an associate holds a secondary place; and besides the drawback of not having any voice in the direction of the body, he runs the risk, if he enters the lists, of being eclipsed, if not quite snuffed out, by the seniors—the anticipation of which makes young men shrink from putting themselves forward. It is matter for congratulation that the new Association is being started without any idea of supplanting or superseding any other body. The juniors are to set up house on their own account; and they will have the freedom to discuss, in their own house, such subjects as they may choose, from the standpoint of the assistant—that is, of the future manager.

The public lighting of Edinburgh continues to be a subject of discussion; the venue being changed to the pages of the newspapers. Mr. A. D. Mackenzie, the Convener of the Electric Lighting Committee, writing in the "Scotsman" on Tuesday, in pleading that the fiat should not go forth that electric lighting should not be further extended, took up the position that burners consuming 3 cubic feet of gas per hour will prove to be insufficient with the incandescent system in wide streets, and that it will be found necessary to use 4-feet burners, with the result that electricity would be about as cheap as gas. Then he said: "I do not write at all in a hostile spirit to improved gas lighting. The gas lighting of the streets of Edinburgh has been a reproach to municipal management for many years since our standard of light has increased. Nor do I join with the outcry against the quality of the gas and the management of the undertaking. People cry for more light; and if they will have this with gas, they must be prepared to burn more of it. But I certainly think it is a very big order that the whole of the 10,000 gas-lamps should be forthwith converted into incandescent lamps, and that there should be no more electric lamps in the streets of Edinburgh—even though these in many cases will not cost more than the gas." The letter is a very fair and moderately worded one. There have been other letters; but they have been by persons of no public standing, and I take no notice of them. Meantime, the Corporation are experimenting with a view to finding out what the light will be with a less consumption of gas than 3 cubic feet per hour.

The following communication, signed by 42 traders, has been sent to the Clerk to the Edinburgh and Leith Gas Commissioners: "We beg to draw your attention to the inexpediency of opening more shops in the city for the sale of gas-stoves and incandesent goods. There are over 300 plumbers and ironmongers who are paying rates for the purpose of selling these goods, who will be injuriously affected by your doing so, and some of them to a very serious extent. It seems to us that—at least so far as incandescent goods are concerned—there is little excuse for you entering into further competition with the trade, as there is no line of business so well catered for, and in which the prices are so much cut. Incandescent burners and mantles can now be purchased at about 500 shops in Edinburgh and Leith, and we cannot see how three more shops can be of much advantage to the public, and we do not think it is your intention to enter into an unfair competition as to prices. Therefore we can see no advantage which the public can possibly secure by your opening these shops. In fact, it seems to us the result would be that many traders would find it was no longer to their advantage to keep these goods for sale; and thus, instead of having 500 depôts of supply, the number would be considerably reduced, causing inconvenience to the public, and unpopularizing this form of lighting. We hope you will see the reasonableness of what we have said, and that you will consider the matter in a favourable light, and cancel the order for opening the shops."

It may be taken as almost a certainty that new gas-works will now

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WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract), 1,800,000 C. Ft. HAMILTON, ONT., 400,000 C. Ft.

be erected by the Corporation of Falkirk, and that the site of the works will be at Thornhill. The Town Council had before them on Monday plans for the new works, which have been prepared by the Engineer and Manager, Mr. W. M'Crae; and they adopted them. Mr. H. Russell, the Convener of the Gas Committee, in moving the adoption of the plans, said it was very necessary the Committee should proceed without delay with the erection of the retort-houses. They must be finished with these before the winter, so that they might get the internal operations proceeded with during the winter months. He heard the statement made almost every other day that the new gas-works were going to be a burden on the rates. This would not be the case. There was not the remotest possibility of the gas undertaking affecting the rates in the slightest degree; and he did not think there was the least likelihood of the new works affecting even the price of gas. The estimated cost of the works was £50,000; but he did not believe they would spend so much. Bailie Bogle rose to propose an amendment. He said he anticipated that while the estimated cost was £50,000, from past experience this meant £70,000; and that the new works were forced upon them by people outside of their district. There were 11,000 people outside who might leave them at any time and erect gas-works of their own. After Bailie Bogle had said his few words, Provost Weir ruled the amendment to be incompetent, and refused to allow Mr. Neilson to speak, because his speaking would only lead to a row. The incident ended in the minute being unanimously adopted. It is a great victory for Mr. H. Russell, who has consistently pressed upon the Council the necessity for new gas-works; and Mr. M'Crae is to be congratulated upon having secured, with so little trouble, the passing of his plans, seeing the Council have been so fickle in their handling of the subject ever since it was raised.

On Thursday, in the Grand Hotel, Glasgow, a two-days proof was closed in an arbitration between the Stranraer Gas Company and Messrs. Kirkwood, Kerr, and Co., Contractors, Glasgow. The dispute was with regard to the construction of a gasholder tank at the Stranraer works, and involved a nice point as to the relative powers and responsibilities of engineers and contractors. Mr. James M'Gilchrist, of Dumbarton, was the sole Arbiter, with Mr. Robert MacFarlane, of Dumbarton, as Clerk and Assessor.

The Town Clerk of Dundee has reported, with reference to the refusal of the Joint Railway Company to carry coal and coke between the Corporation gas-works and the harbour of Dundee, that, according to section 2 of the Railway and Canal Traffic Act, 1854, railway companies are required to afford all reasonable facilities for the forwarding and carrying of traffic upon their several railways, but that they are not required to carry traffic from private sidings. There is a Bill at present before Parliament, read a second time on March 18, which seeks to compel railway companies to give the same facilities for the carriage of traffic from private sidings as on their main lines. The Town Clerk is of opinion that complaint can be made in the matter to the Railway Commissioners or to the Board of Trade. This recommendation came before the Gas Committee on Tuesday; and they resolved to take joint action with the Harbour Trustees in proceedings before the Board of Trade.

It is intimated that the new gas-works which have been erected for the Corporation of Kilmarnock are to be formally opened on Tuesday, the 10th of May next.

Mr. Alex. Yuill has reported to the Gas Committee of the Dundee Corporation, with reference to the proposal to convert all the public lamps in the city into incandescent gas-lamps, that the cost at present amounts to £7386, and that the cost of incandescent lighting would be £8625. The Committee deferred consideration of the subject.

The Dalziel Parish Council have erected a poorhouse, to serve Motherwell and district. The other day the subject of the lighting of the new building came up for consideration. It was pointed out that the present poorhouse is lighted by gas at a cost of from £15 to £20 a year, and that to light the new building with electricity would cost from £50 to £60 a year. After some discussion, the proposal to light the house with electricity was carried by 10 votes to 8. By this means, the Corporation of Motherwell obtain an excellent customer for their electricity department, which is rather a costly one.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 23.

Sulphate of Ammonia.

Throughout the week the market has been slow, and values have declined at all points; the closing quotations being £12 5s. per ton f.o.b. Hull and £12 7s. 6d. per ton f.o.b. Liverpool and Leith. Continental requirements being covered by home production and contracts made in advance, and Spanish buying having fallen off, the large makers in London and Scotland have been compelled to abandon the firm attitude they have until recently maintained, demand being scarcely equal to supply. The home trade, too, has on the whole been disappointing. The forward position is altogether neglected, the trend of the market discouraging forward operations.

Nitrate of Soda.

This is in good demand both in the United Kingdom and on the Continent, and local prices have, owing to scarcity of supplies, been advanced to 10s. 3d. and 10s. 6d. per cwt., for ordinary and refined qualities respectively.

LONDON, *April* 22.

Tar Products.

There was rather more business doing during the past week, although in most instances at slighly lower prices. A considerable quantity of pitch was placed in the North of France; but at very low prices, especially for delivery over the last six months of the present

THE
MAXIM PATENT CARBURETTOR
FOR ENRICHING GAS IN BULK.
PREVENTS NAPHTHALENE DEPOSITS.
OVER 120 MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.
Among the Companies and Towns supplied are The Gaslight and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Oldham, Dundee, Perth, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Ten Years.
MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.
THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.
The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.
Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.
For Prices and full Particulars, apply to
THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,
18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

year. In Belgium, dealers are offering for forward delivery at a reduction on previous quotations; but consumers do not seem inclined to purchase forward, evidently believing that lower prices may rule later on. In South Wales, there are still inquiries; but consumers decline to pay the prices asked by dealers, although at present there is not a great difference between buyers and sellers as regards value. In London, there is no business to report. It is evident, however, that dealers are at present open to accept lower prices than those actually quoted by manufacturers. In benzol, there has been a fairly good business done in both 90 and 50-90 per cent. for home consumption; but there does not appear to have been any business done with the Continent. Solvent remains in a most depressed condition. There is a good deal offering for early delivery; while the demand for home consumption appears to have fallen off, especially for prompt. The position of toluol remains unchanged, and consumers do not seem to take any interest at all in the article. There is still a fair inquiry for creosote; but prices do not show signs of improvement. A good deal is offering for early delivery, especially in the North of England. It is difficult to fix the actual value of anthracene. There are rumours of business having been done in "A" quality, at fairly good prices, for delivery over the last six months of the present year; but considerable uncertainty prevails as to the actual figures realized. The improvement in carbolic acid continues. A large business was done in the early part of the week at 1s. 11½d. and 1s. 11⅝d.; while the market closes firm at 2s. for May-June delivery, at which price there are now buyers. In crystals, for early delivery makers are firmer in their ideas; but there is not very much offering for prompt shipment. Most makers, however, seem anxious to sell for July-December; and for this period they will accept a slight reduction on existing quotations.

The average values during the week were: Tar, 17s. 6d. to 23s. Pitch, London, 33s. to 33s. 6d.; east coast, 32s. to 32s. 6d.; west coast, 31s. to 31s. 6d. Benzol, 90 per cent., 9½d. to 10d.; 50-90 per cent., 7d. Toluol, 6½d. to 7d. Crude naphtha, 3d. to 3¼d.; solvent naphtha, 6½d. to 8d.; heavy naphtha, 10d. to 11d. Creosote, London, 1 9/16d. to 1⅝d.; North, 1¼d. Heavy oils, 2¼d. to 2⅜d. Carbolic acid, 60 per cent., 1s. 11½d. to 2s. Refined naphthalene, £5 to £8; salts, 22s. to 24s. Anthracene, "A" quality, 1¾d. to 2d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market closes with a very quiet tone; and prices generally are easier all round. Beckton quote £12 6s. 3d., but would no doubt accept £12 5s. for early delivery. The South Metropolitan still ask £12 10s., on their own special terms; but there is no chance of business at this price. The market at Leith is very quiet; and there is no business to report. Sellers ask £12 7s. 6d. to £12 10s.; but buyers are not prepared to pay this price, and do not seem to take much interest in the article for forward delivery. There is a fairly good demand for immediate shipment at Hull; and £12 8s. 9d. is reported to have been paid in one instance. The market value, however, is certainly not more than £12 7s. 6d. In Liverpool, the market is very dull; and sales are reported as low as £12 6s. 3d. for early shipment.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Business generally throughout the coal trade of this district is moving on moderately; and now that the collieries have got through the orders that had accumulated, supplies are more than ample to meet requirements, and pits are again getting on to short time. House-fire qualities have undergone no further change in prices. Coalowners in the Lancashire districts outside the Manchester radius have only in very exceptional cases reduced their prices, except where they have to meet the competition of the lower Manchester rates. It seems, however, tolerably certain that before long they will have to follow with a more or less general reduction, as there is a want of firmness throughout the market. The average quoted prices remain about 13s. to 14s. per ton at the pit for best Wigan Arley, 11s. to 12s. for seconds Arley and Pemberton four-feet, and 9s. and 9s. 6d. up to 10s. 6d. for common house-fire coals. Reports as to the lower qualities of round coal continue generally unsatisfactory, both as to demand and price. Common steam coals are to be bought from 7s. 9d. to 8s. 3d. per ton at the pit, with better qualities quoted 8s. 6d. to 8s. 9d. With regard to gas-coal contracts, the further particulars which have come to hand show the position to be weak and irregular. In one or two instances, common gas coals for which 8s. 5d. per ton was obtained in 1903 have been contracted for this year at 7s. 11d. at the pit; in other cases, collieries have been able to secure small contracts on last year's basis. The business so far put through, however, scarcely affords any reliable indication as to what prices may be when the more important contracts come forward for settlement; but the general indications are, as previously pointed out, in the direction of lower prices than last year. Of engine fuel, there are fairly plentiful supplies on the market. Prices are weak, especially in the lower sorts, which have to meet the competition of common slack coming in from other districts. Best slacks remain about 6s. to 6s. 6d. per ton at the pit, good medium sorts about 5s. to 5s. 6d., and common slacks from about 3s. 9d. to 4s. 3d. and 4s. 6d. Shipping orders have been taken for delivery at just under 6s. per ton, to enable them to escape the export duty. Steam coals for shipment also continue to be quoted low, averaging 9s. to 9s. 3d. per ton at the ports.

Northern Coal Trade.

There is a quieter tone in the coal market, due in part to the fact that the Cronstadt trade is a little later in opening out than there had been expectations of, and also to the lessened requirements of several large consuming industries. Still, the collieries seem to be actively

COIN COLLECTING CONVEYANCES

Design No. 2. With body in position.

REDUCED PRICES.

No. 1 DESIGN (Fixed Body), £7 10s. Net.

No. 2 DESIGN (Detachable Body) £8 Net.

EXTRA STRONG WHEELS 28 inches diameter.

Painted and Lettered to Instructions.

MILES PLATTING, MANCHESTER. SAWER & PURVES, GT. FREEMAN ST., NOTTINGHAM.

employed, and the days that are worked at the pits is, on the average, a little fuller than had been the case in the past year. Best Northumbrian steam coals are in moderate demand; and the price is from 10s. 6d. to 11d. per ton f.o.b., according to the period over which the delivery is to be made, second-class steams are 9s., and steam smalls from 4s. 9d. to 5s. 6d. In the gas coal trade, the great contracts are now actually concluded. The prices range substantially from 7s. 6d. to 8s. 3d. per ton f.o.b. A small contract for good gas coal for export has just been settled at about 8s. per ton f.o.b. For occasional cargoes, the market is steady, and the range of prices is generally between the figures just given, according to the quality. Gas coke is now less plentiful. The price is firmly held; while stocks seem to be lessened—the quotation for good qualities being from 13s. to 13s. 6d. per ton f.o.b. on Tyneside.

Scotch Coal Trade.

There is a fairly active trade, with matters looking a little better. The demand for export is improving. The prices quoted are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 3d. to 9s. 9d., and splint 8s. 9d. to 9s. The shipments for the week amounted to 222,787 tons—an increase of 35,649 tons upon the preceding week, and of 29,232 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,875,652 tons—an increase of 13,763 tons upon the same period of 1903.

Springfield (Mass.) Water Supply.—A new water supply for Springfield (Mass.), to be taken from the Westfield River, near Huntington, has been recommended by the Consulting Engineers to the city. The total cost for a supply of 25 million gallons daily is put at £757,298, exclusive of filtration, which is estimated to cost about £100,000 additional. The present water consumption of Springfield is 9,435,000 gallons daily, or about 150 gallons per head. The reason for the high consumption is partly the use of water for motive power. It was found that ventilating fans in the public schools were employing 825,000 gallons of water per day.

Incandescent Gas Lighting at Herne Bay.—The Herne Bay Urban District Council have renewed the public lighting contract for five years from the 30th of June next, upon condition that the whole of the lanterns throughout the district are fitted with incandescent burners. The cost of this, together with the alteration of the lanterns so as to make them suitable, is being divided between the Council and the Gas Company; the latter bearing something more than one-half. The repayment to the Company of the Council's share of the cost will extend over the term of the contract. The proposition originated with the Company, of which Mr. C. V. Bennett is Manager.

Messrs. Biggs, Wall, and Co. have received an order from the Clevedon Gas Company for an installation of their "Rapid" charging machine.

The Gandy Belt Manufacturing Company, Limited, of Seacombe, Cheshire, have opened a new branch at No. 16, Grey Friar Gate, Nottingham.

The Great Western Railway Company have placed a fourth repeat order with Messrs. Robert Dempster and Sons, Limited, of Elland, for their patent regenerator settings.

Messrs. John Wright and Co., Limited, have appointed Mr. W. R. Francis as their Managing Representative for the Midlands, West of England, and South Wales. Mr. Francis has had a wide experience, having represented the firm for a number of years, latterly in the North.

The Gas Committee of the Southport Corporation expect to be in a position to hand over £10,000 in relief of the rates; the gas undertaking being in a very good financial position. This is an advance of £1250 on last year's contribution, and it is equal to a rate of almost 1d. in the pound.

In a report issued by the Gas Committee of the Smethwick Corporation, an offer is made to contribute £5000, in five annual instalments of £1000 each, towards the cost of a scheme which has been formulated for the provision of new municipal buildings, which will include new offices for the Gas Department.

The Water and Gas Securities Exchange, Limited, has been registered in Guernsey with a capital of £1,000,000, in £10 shares (to be converted, when paid, into £999,750 preference stock and £250 deferred stock), to carry on the business indicated by the title, and the general business of financial agents, brokers, capitalists, &c.

Combustible gas, emanating in large quantities from fissures in the marl in the rock salt mines in Hungary and Switzerland, has been used for lighting the workings. Gas collected from the fissures in cast-iron pipes has also been employed for this purpose in the salt mines in Wieliczka. According to the "Engineer," advance bore-holes are now driven to detect the occurrence of accumulations of gas.

Messrs. George Newton, Limited, Oldham, have issued a new catalogue (which cancels previous lists) of their wet and dry meters, station meters, station governors, gauges, main cocks, gas-fire fittings, &c. It is fully illustrated; and in the case of the meters, the "lights," measuring capacities, prices, and stamping fees are all plainly set out. Taps of all kinds and bunsen burners are illustrated and priced.

Messrs. Joseph Taylor and Co., of Bolton, have secured orders for one of their latest saturators, including the whole of the lead and timber work in connection with the sulphate of ammonia plant now being erected for the Windsor Royal Gas Company, and for a similar plate-lead saturator for the Walton-on-the-Hill Gas-Works, specified by the Consulting Engineer (Mr. Isaac Carr). The firm have also in hand saturators, acid tanks, &c, for the St. Mary Church, Torquay, and St. Albans Gas-Works.

The "MAIN"

Gas Cooker

WITH LATEST DEVELOPMENTS.

SPECIAL FEATURES.

OUR NEW PATENT ENAMEL is guaranteed free from Lead or other Poisonous Chemicals.

Inside Fittings, Porcelain Enamelled.

Can be supplied with Moveable Burners, if desired.

ORDERS DESPATCHED SAME DAY AS RECEIVED.

R. & A. MAIN, LTD.,

LONDON: 49, Queen Victoria Street. | GLASGOW: 26, West Nile Street. | FALKIRK: Gothic Works.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

REPRESENTATIVE OF COAL MERCHANT. No. 4198.
MANAGER. Athy Gas-Works.
WORKING MANAGER. Woodbridge Gaslight Company. Applications by May 5.
MANAGER AND CARBONIZER FOR SMALL WORKS. No. 4202.
STOKER. Daventry Gas-Works.

Situations Wanted.

ASSISTANT-MANAGER. No. 4178.
CANVASSER. No. 4201.

Plant for Sale.

CONDENSER (250,000 feet). Redditch Gas-Works.
INCANDESCENT MANTLE FACTORY. No. 4200.
MOUTHPIECES, HYDRAULIC MAIN, VALVE, &c. Sutton Gas-Works.
PURIFIERS, &c. Blyth and Cowpen Gas Company.
TABLE ENGINES (two). No. 4196.

Plant Wanted.

PURIFIERS. Brackley Gas-Works.

Mortgage Wanted. Blyth, Dutton, Hartley, and Blyth, London.

Shares, &c., for Sale.

BRISTOL WATER COMPANY. May 5.
CANTERBURY GAS AND WATER COMPANY. May 18.
GREAT YARMOUTH GAS COMPANY. May 17.
LAMBETH WATER COMPANY. May 9.
LEA BRIDGE GAS COMPANY. May 17.
SWANAGE GAS AND WATER COMPANY. May 17.

TENDERS FOR

Benzol.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 10.

Boiler.
FERNDALE GAS COMPANY.

Coal and Cannel.
EASTBOURNE GAS COMPANY. Tenders by May 2.
KIDSGROVE GAS COMPANY. Tenders by April 30.
RETFORD GAS DEPARTMENT. Tenders by April 30.
WATFORD GAS COMPANY. Tenders by May 9.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 10.

Condenser.
FERNDALE GAS COMPANY.

Cookers.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 10.

Meters.
ROTHERHAM GAS DEPARTMENT. Tenders by May 2.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 10.

Paint and Oil.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 10.

Pipes and Specials, &c.
SUTTON GAS COMPANY. Tenders by April 28.
WILMSLOW AND ALDERLEY EDGE GAS COMPANY. Tenders by May 3.

Retort-House Roof and Cover for Tar-Tank.
FERNDALE GAS COMPANY.

Retort Stack, Mountings, &c.
FERNDALE GAS COMPANY.

Tar, Ammoniacal Liquor, &c.
DUMFRIES GAS DEPARTMENT. Tenders by April 30.
HUDDERSFIELD GAS DEPARTMENT. Tenders by May 10.

Water-Gas Plant, &c.
DEVONPORT GAS DEPARTMENT. Tenders by May 17.
EDINBURGH AND LEITH GAS COMMISSIONERS. Tenders by May 9.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 218.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 14	10½	Alliance & Dublin	10 p.c.	19—20*	..	5 5 0
100,000	10	,,	7½	Do.	7 p.c.	13—14*	..	5 7 2
200,000	5	Nov. 12	6½	Bombay, Ltd.	. . .	6—6½	..	5 4 0
140,000	5	,,	6½	Do. New, £4 paid		4½—5	+½	5 4 0
380,000	Stk.	Feb. 25	12	Brentford Consolidated		737—742	+7	4 19 2
300,000	,,	,,	9	Do. New	. . .	178—183	+3	4 18 4
50,000	,,	,,	5	Do.	5 p.c. Pref. .	127—132	..	3 15 9
206,250	,,	Dec. 11	4	Do.	4 p.c. Deb. .	103—108	..	3 14 1
220,000	Stk.	Mar. 10	10½	Brighton & Hove Orig.		205—210	+2	5 2 4
246,320	,,	,,	7½	Do.	A. Ord. Stk. .	145—150	+2	5 3 4
460,000	20	Apl. 14	10	British.	. . . . .	38—39*	..	5 2 7
100,000	Stk.	Feb. 25	6	Bromley, Ord.	5 p.c. .	112—117	..	5 2 7
165,700	,,	,,	4½	Do.	do. 3½ p.c. .	85—90	..	5 0 0
500,000	10	Oct. 15	7	Buenos Ayres (New)	Ltd	11—11½	+½	6 1 9
250,000	Stk.	Dec. 30	4	Do.	4 p.c. Deb.	91—93	..	4 6 0
150,000	20	Mar. 10	8½	Cagliari, Ltd.	. . .	21—23	..	7 3 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.		14—15	..	6 13 4
50,000	50	Nov. 3	6	Do.	6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 25	5⅛	Commercial	4 p.c. Stk.	104—109	..	4 15 5
556,485	,,	,,	5	Do.	3½ p.c. do.	102—105	..	4 15 3
442,947	,,	Dec. 11	3	Do.	3 p.c. Deb. do.	85—87	+½	3 9 0
800,000	Stk.	Dec. 30	7	Continental Union, Ltd.		112—117	+2	5 10 8
200,000	,,	,,	7	Do.	7 p.c. Pref.	137—142	+2	4 18 7
575,000	Stk.	Feb. 25	5⅛	Crystal Palace Ord.	5 p.c.	115—120	+2	4 8 10
60,000	,,	,,	5	Do.	5 p.c. Pref. .	115—120	..	4 3 4
112,533	,,	Jan. 14	5	Do.	5 p.c. Deb. Stk.	134—137	..	3 13 10
486,090	10	Jan. 28	10½	European, Ltd.	. . .	18½—19½	..	5 7 8
354,060	10	,,	10½	Do.	£7 10s. paid	13½—14½	..	5 8 8
15,243,200	Stk.	Feb. 11	4⅛	Gas-light and Coke	4 p.c. Ord. . .	93—95	..	4 12 7
2,600,000	,,	,,	3⅜		3⅜ p.c. max. .	88—90	..	3 17 9
3,799,735	,,	,,	4		4 p.c. Con. Pref.	104—107	..	3 14 9
4,193,975	,,	Dec. 11	3		3 p.c. Con. Deb.	87—89	..	3 7 5
258,740	Stk.	Mar. 10	5	Hastings & St. L.	3½ p.c.	90—95	+2	5 5 3
70,000	10	Oct. 15	11	Hongkong & China, Ltd.		16—17	..	6 9 5
3,800,000	Stk.	Nov. 12	10	Imperial Continental	.	203—208	+1½	4 16 2
473,600	Stk.	Feb. 11	3½	Do.	3½ p.c. Deb. Red.	98—100	+1	3 10 0
165,242	Stk.	Mar. 10	6	Lea Bridge Ord.	5 p.c.	112—117	+7	5 2 7
561,000	Stk.	Feb. 25	10	Liverpool United A	.	210—211	+½	4 14 9
718,100	,,	,,	7	Do.	do. B .	158½—160½	..	4 7 3
306,083	,,	Dec. 30	4	Do.	do. Deb. Stk.	108—110	..	3 12 9
75,000	5	Dec. 11	5	Malta & Medn., Ltd.	.	4¼—4¾	..	5 5 3
360,000	100	Apl. 5	5	Met. of	5 p.c. Deb.	100—103	..	4 17 1
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	101—102	..	4 8 3
541,920	20	Nov. 12	3½	Monte Video, Ltd.	.	9½—10⅜	..	6 13 4
1,515,892	Stk.	Feb. 26	4½	Newc'tle & G'tesh'd	Con.	103⅜—104½	−1	4 6 2
406,025	Stk.	Dec. 31	3½	Do.	3½ p.c. Deb.	93⅜—94½	..	3 14 1
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	. . .	135—140	..	5 14 4
600,000	5	Mar. 29		Ottoman, Ltd.	. . .	5⅞—6	..	5 16 8

* Ex div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	Jan. 14	6½	Ply'mth & St'house	5 p.c	121—126	..	4 17 2
851,070	10	Oct. 15	7	River Plate Ord.	. .	12—12½	+¼	5 12 0
300,000	Stk.	Dec. 30	4	Do.	4 p.c. Deb..	92—94	..	4 5 1
250,000	10	Mar. 29	7	San Paulo, Ltd.	. . .	11—12	+⅛	5 16 8
135,000	Stk.	Mar. 10	10	Sheffield A	. . . .	236—238	..	4 4 0
209,984	,,	,,	10	Do.	B	235—237	..	4 4 5
523,498	,,	,,	10	Do.	C	234—236	..	4 4 9
116,106	Stk.	Mar. 29	5	Shrewsbury Ord.	5 p.c.	107—110	..	4 10 11
6,150,000	Stk.	Feb. 11	5½	South Met.,	4 p.c. Ord.	123—126	..	4 4 7
1,832 700	,,	Jan. 14	3	Do.	3 p.c. Deb. . .	85—89	..	3 7 5
380,940	Stk.	Nov. 12	5	Southampton Ord.	. .	105—110	..	4 10 11
87,950	,,	Jan. 14	4	Do.	4 p.c. Deb.	100—103	..	3 17 8
120,000	Stk.	Feb. 25	6	Tottenham and Edmonton	A. 5 p.c.	115—120	+3	5 0 0
313,020	,,	,,	4½		B. 3½ p.c.	55—100	+2	4 10 0
182,380	10	Dec. 30	8	Tuscan, Ltd.	. . . .	£⅞—9	..	8 17 10
149,000	10	Jan. 2	5	Do.	5 p.c. Deb. Red.	97—99	..	5 1 0
745,872	Stk.	Mar. 10	5	West Ham,	5 p.c. Ord.	95—100	..	5 0 0
				WATER COMPANIES.			
781,517	Stk.	Dec. 30	12	Chelsea, Ord.	. .	352—357	+2	3 7 3
150,000	,,	,,	5	Do.	5 p.c. Pref. .	142—147	..	3 8 0
160,000	,,	,,	4½	Do.	4½ p.c. Pref. '75	132—137	..	3 5 8
175,785	,,	Mar. 29	4½	Do.	4½ p.c. Deb. .	130—135	..	3 6 8
1,720,560	Stk.	Mar. 29	8	East London, Ord.	. .	218—223	+1	3 11 9
654,740	,,	Dec. 11	4½	Do.	4½ p.c. Deb. .	130—135	..	3 6 8
1,524,288	,,	,,	3	Do.	3 p.c. Deb. .	87—90	..	3 6 8
700,000	50	,,	10	Grand Junction	10 p.c. max..	136—139	..	3 11 11
310,000	Stk.	Mar. 29	4		4 p.c. Deb..	115—120	+2	3 6 8
708,000	Stk.	Feb. 25	10	Kent	. . . . .	315—320	..	3 2 6
160,000	,,	,,	7	Do. New,	7 p.c. max..	217—222	..	3 3 0
1,043,800	100	Dec. 30	11	Lambeth,	10 p.c. max..	312—317	..	3 9 5
406,200	100	,,	8½	Do.	7½ p.c. max..	223—233	..	3 13 0
550,000	Stk.	Mar. 29	4	Do.	4 p.c. Deb..	115—120	+2	3 6 8
500,000	100	Feb. 25	10	New River, New Shares		360—370	..	2 14 0
1,000,000	Stk.	Jan. 28	4	Do.	4 p.c. Deb..	117—120	+1	3 6 8
902,300	Stk.	Dec. 30	7½	South-wark and	Ord. . . .	275—280	+2	2 13 7
126,500	100	,,	7½		7½ p.c. max.	215—225	..	3 6 8
489,200	Stk.	,,	5		5 p.c. Pref. .	144—149	..	3 7 1
1,019,585	,,	Mar. 29	4	Vauxhall	4 p.c. A Deb.	115—120	+2	3 6 8
1,155,066	Stk.	Dec. 11	10	West Middlesex.	. .	291—300	+2	3 6 8
200,000	,,	,,	4½	Do.	4½ p.c. Deb. .	130—135	..	3 6 8
200,000	,,	Mar. 10	3	Do.	3 p.c. Deb. .	88—90	..	3 6 8

* Ex div.

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APPLICANTS for the Positions of Clerk and DRAUGHTSMAN advertised for in the "JOURNAL" of March 22, are informed that the APPOINTMENTS HAVE NOW BEEN MADE.

J. H. BROWN,
Engineer and General Manager.

Gas Offices, Nottingham,
April 22, 1904.

TO GAS-STOVE MANUFACTURERS.

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J. FIRTH BLAKELEY AND CO., Gas Engineers, Thornhill, DEWSBURY.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply and delivery, at Handforth Station, of 1500 yards of 6-inch, and 900 yards of 4-inch Socket and Spigot CAST-IRON PIPES; also a few SPECIALS.
Tenders, endorsed "Mains," and addressed to the Chairman, must be delivered not later than Tuesday, May 3, 1904.
Further Particulars may be had on application to the undersigned.

WM. SEVERS,
Engineer and Manager.

Gas-Works, Wilmslow,
Manchester, April 21, 1904.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of about 4000 Tons of GAS COAL (screened or unscreened), and 1000 Tons of CANNEL, for the Year ending June 30, 1905.
Tenders, endorsed "Gas Coal," to be delivered to W. H. Welsh, Esq., 52, Brown Street, Manchester, not later than Ten a.m. on Tuesday, the 10th day of May, 1904.
Forms of Tender may be had on application to the undersigned.
The Directors do not bind themselves to accept the lowest or any Tender.

WM. SEVERS,
Engineer and Manager.

Gas-Works, Wilmslow,
April 23, 1904.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for their requirements as under for the Year ending June 30, 1905.
GAS-METERS (dry), GAS-COOKERS, PAINT, OIL, and BENZOL, delivered at the Company's Works.
Also for CARTING for One, Two, or Three Years.
Particulars as to Quantities required. Copies of Specification, and Forms of Tender, can be had from the undersigned.
Tenders, endorsed "Tender for ———," must be delivered to W. H. Welsh, Esq., Secretary, 52, Brown Street, Manchester, not later than noon on Tuesday, the 10th day of May, 1904.
The Directors do not bind themselves to accept the lowest or any Tender.

WM. SEVERS,
Engineer and Manager.

Gas-Works, Wilmslow,
April 23, 1904.

EASTBOURNE GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 25,000 Tons of Clean, Dry, unscreened, Fresh-Wrought GAS COALS, delivered at Eastbourne Railway Station during the Year ending the 31st of August, 1905.
Also for 30,000 Tons delivered during the Year ending the 31st of August, 1906.
Also for 30,000 Tons delivered during the Year ending the 31st of August, 1907.
The deliveries to be in about equal monthly quantities.
Payment in cash monthly.
Parties desirous of tendering for more than One Year must do so upon separate Forms.
Particulars and Forms of Contract may be obtained from the Secretary.
The Directors do not bind themselves to accept the lowest or any Tender.
Tenders, sealed and endorsed "Tender for Coals," to be addressed to the Chairman of the Company, at the Offices, 1, Sussex Gardens, Eastbourne, on or before May 2 next.

By order,
JAMES S. GARRARD,
Secretary.

April 20, 1904.

COUNTY BOROUGH OF ROTHERHAM.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of Ordinary and Automatic DRY METERS as may be required during the ensuing Twelve Months.
Further Particulars may be had on application to the Engineer and Manager, at the Gas Offices.
Tenders to be addressed to the undersigned, and to be received not later than May 2 next.

H. HAMPTON COPNALL,
Town Clerk.

RETFORD CORPORATION.
(GAS UNDERTAKING.)

THE Gas Committee of the above Corporation are open to receive TENDERS for the supply of 6000 Tons of Screened, Unscreened, GAS COAL or GAS NUTS during the ensuing Twelve Months, to be delivered at the Sidings of the G.N. or G.C. Railways, Retford.
Forms of Tender or further Particulars may be obtained from the undersigned.
Sealed Tenders to be sent in, addressed to the Chairman of the Gas Committee, endorsed "Tender for Gas Coal," on or before the 30th inst.

J. B. FENWICK,
Engineer and Manager.

Gas and Water Offices,
Retford, April 21, 1904.

TENDERS FOR GAS COAL.

THE Directors of the Watford Gas and Coke Company invite TENDERS for the supply of 11,500 Tons (more or less) of GAS COAL, screened or unscreened, to be delivered at the Bushey Station of the London and North-Western Railway between July 1, 1904, and June 30, 1905.
Forms of Tender and all Information may be obtained on application, in writing only, to me the undersigned.
Tenders must be on the Form supplied, any alteration of which will invalidate the Tender.
Tenders to be delivered on or before the 9th day of May, 1904, addressed to the Chairman of the Watford Gas and Coke Company, Watford, endorsed "Tender for Gas Coal."
The Directors do not bind themselves to accept the lowest or any Tender.

J. DUNCAN ROYAL,
Secretary.

Watford Gas and Coke Company's Offices,
Watford, April 18, 1904.

SUTTON GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 1760 Yards (or thereabouts) of 6-inch and 4500 Yards (or thereabouts) of 3-inch Socket and Spigot MAIN PIPES; the whole of the 6-inch and 1760 Yards of the 3-inch to be delivered to Banstead Station (L.B. & S.C. Rly.), the balance of the 3-inch to Sutton Station.
Pipes may be either English or Foreign; but the quotation must indicate which is being tendered for, also the approximate weight of Pipes and the Price per ton coated and delivered at the above-mentioned Stations, and the time of delivery.
Tenders, to be marked "Tender for Pipes," and to be addressed to the Secretary, Gas Office, Sutton, Surrey, not later than Thursday, April 28, 1904.
The Directors do not bind themselves to accept the lowest or any Tender.

By order of the Board,
GEO. MEAD-ROBINS,
Secretary and Engineer.

April 19, 1904.

COUNTY BOROUGH OF HUDDERSFIELD.

TO TAR DISTILLERS, &c.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the surplus TAR produced at their Works for Twelve Months from the 1st of July, 1904, or such other term as may be agreed upon.
Particulars respecting Quantity, &c., may be had on application to the Gas Engineer and Manager (Mr. E. A. Harman), Gas-Works, Huddersfield.
Sealed Tenders, endorsed "Tender for Tar," must be delivered free of charge, addressed in the handwriting of the tenderer or his agent, to the Town Clerk, Town Hall, Huddersfield, not later than Tuesday, the 10th day of May, 1904.
The Corporation do not bind themselves to accept the highest or any Tender.

By order,
J. HENRY FIELD,
Town Clerk.

Town Hall, Huddersfield,
April 19, 1904.

DEVONPORT GAS-WORKS.
CONTRACT No. 10.

THE Corporation of Devonport are prepared to receive TENDERS for the construction and erection of a WATER-GAS PLANT.
Copies of the Specification and Form of Tender, together with a Drawing showing the situation of the Plant and the necessary Piping for connecting to the existing Works, can be obtained, on and after Tuesday, the 26th day of April, 1904, at the Offices of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster, or at the Gas-Works, Devonport.
A charge of Two Guineas will be made for each copy of the Specification and Drawing, which will be returned on receipt of a *bonâ-fide* Tender accompanied by the Drawing.
Tenders must be delivered, sealed, addressed to the undersigned, at the Town Clerk's Offices, Devonport, on or before noon of Tuesday, the 17th day of May, 1904.
The Corporation do not bind themselves to accept the lowest or any Tender.

R. J. FITTALL,
Town Clerk.

Town Clerk's Office,
Devonport, April 19, 1904.

TAR Contracts Wanted on the Sliding-Scale or at Fixed Prices.
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

KIDSGROVE GASLIGHT COMPANY.

TENDERS are invited for the supply of about 4000 Tons of GAS COAL to be delivered at these Works during the Twelve Months ending June 30, 1905.
Sealed Tenders, on Contractor's own Form, to be addressed to the Chairman, and delivered to me not later than April 30.

JAMES BEECH,
Manager and Secretary.

Gas-Works, Kidsgrove.

THE Directors of the Ferndale Gas Company, Limited, are prepared to receive TENDERS for the supply and erection of a RETORT-STACK, RETORT-STACK MOUNTINGS, RETORT-HOUSE ROOF and GIRDER, CONDENSER, BOILER, and COVERING OF TAR-TANK.
Particulars may be obtained from the Engineers, Messrs. Thomas Newbigging & Son, 5, Norfolk Street, Manchester, on payment of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender.

JOSEPH SPRAGUE,
Secretary.

Ferndale, April 22, 1904.

TAR AND LIQUOR CONTRACT.

THE Dumfries Gas Commissioners invite OFFERS for the purchase of all surplus TAR (probable quantity 102,000 gallons) and LIQUOR (probable quantity 356,000 gallons) produced at their Works for One Year between the 15th of May, 1904, and the 15th of May, 1905.
Endorsed Tenders, quoting price per 100 gallons for the Tar, and price per 100 gallons for Tweaddell Liquor, loaded into purchaser's own Tank-Waggons at the Gas-Works, to be sent to John Grierson, Esq., Town Clerk, on or before the 30th of April, 1904.
The highest or any Tender may not be accepted.

Gas-Works, Dumfries,
April 13, 1904.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GRANTON WORKS.
CONTRACT No. 9.
GAS PLANT AND APPLIANCES.

THE Commissioners are prepared to receive TENDERS for the supply, delivery, and erection of supplementary Plant and Appliances for CARBURETTED WATER-GAS INSTALLATION at the Granton Gas-Works.
Specifications, Schedule of quantities, and Form of Tender may be obtained on application to Mr. W. R. Herring, M.Inst.C.E., Chief Engineer and Manager, on receipt of a crossed cheque for £3 3s., which will be returned when a *bonâ-fide* Tender is received.
The Drawings may be inspected by appointment, and further Information obtained upon application to the Engineer, New Street Works, Edinburgh.
Sealed Tenders must be addressed and delivered to the undersigned on or before Ten a.m., the 9th day of May, 1904.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
April 15, 1904.

LAMBETH WATER-WORKS COMPANY.

NOTICE is Hereby Given, that it is the intention of the Company to SELL BY TENDER £70,000 OF THREE PER CENT. DEBENTURE STOCK, redeemable at par, at the option of the Company (or their successors), on six months' notice at any time after the expiration of 25 Years from the date of issue.
Particulars, Conditions of Sale, and Forms of Tender may be obtained at the Company's Office, Brixton Hill, S.W.
Sealed Tenders are to be delivered at the said Office not later than Twelve o'clock noon on Monday, the 9th day of May, 1904.

H. WILKINS,
Secretary.

Brixton Hill, S.W., March 29, 1904.

BRISTOL WATER-WORKS COMPANY.

SALE OF ORDINARY STOCK.

MESSRS. ALEXANDER, DANIEL, AND CO. will SELL BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, the 5th of May, 1904, at Three o'clock in the Afternoon,

£15,000

BRISTOL WATER-WORKS 7 PER CENT. MAXIMUM CONSOLIDATED ORDINARY STOCK in Lots of £100,

At the reserved price of £147 for every £100 Stock.
The above £15,000 Stock is part of the 7 per cent. Maximum Consolidated Ordinary Stock, amounting to £690,000, created under the powers of the Bristol Water-Works Acts, 1888, 1889, and 1895.
The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full; but such diminution may be made up in subsequent years.
For further Particulars and Conditions of Sale apply to the AUCTIONEERS, Bank Chambers, Corn Street, BRISTOL; to Messrs. EDWARD GERRISH AND CO., Lloyds Bank Buildings, Corn Street, BRISTOL; or to

ALFRED J. ALEXANDER,
Secretary and General Manager,
Bristol Water-Works Office,
Telephone Avenue, Bristol.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LEA BRIDGE DISTRICT GAS COMPANY.

NEW ISSUE OF £10,000 CONSOLIDATED ORDINARY STOCK AND £2000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 17, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SWANAGE GAS AND WATER COMPANY.

NEW ISSUE OF £2500 FOUR-AND-A-HALF PER CENT. PREFERENCE "GAS" STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION at the Mart, E.C., on Tuesday, May 17, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

GREAT YARMOUTH WATER-WORKS COMPANY.

SALE BY AUCTION OF 500 £10 ORDINARY SHARES,

Ranking for 7 per cent. Dividend, 4 per cent. having been paid on Similar Shares in the Company for 8 years' past.

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MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 17, at Two o'clock, in Lots, by order of the Directors.

Particulars of Sale, with Form of Instructions for the Auctioneer or Secretary to purchase for Investors unable to attend the Auction, obtainable, post free of the SECRETARY of the Company, GREAT YARMOUTH, or of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

CANTERBURY GAS AND WATER ACT, 1890.

SALE OF NEW "A" AND "B" STOCKS
IN THE
CANTERBURY GAS AND WATER COMPANY.

MR. FRANK AMOS is instructed by the Directors to SELL BY AUCTION, at the Mart, St. Margaret's Street, Canterbury, on Wednesday, May 18, 1904, at Three o'clock p.m. precisely.

£2500 NEW "A" AND "B" STOCKS
IN THE
CANTERBURY GAS AND WATER COMPANY
in 250 Lots of £10 each, authorized by the above-named Act.

Particulars and Conditions of Sale may be obtained of the Secretary, at the Offices of the Company, Castle Street, Canterbury, or of Mr. FRANK AMOS, F.S.I., 3, The Parade, CANTERBURY.

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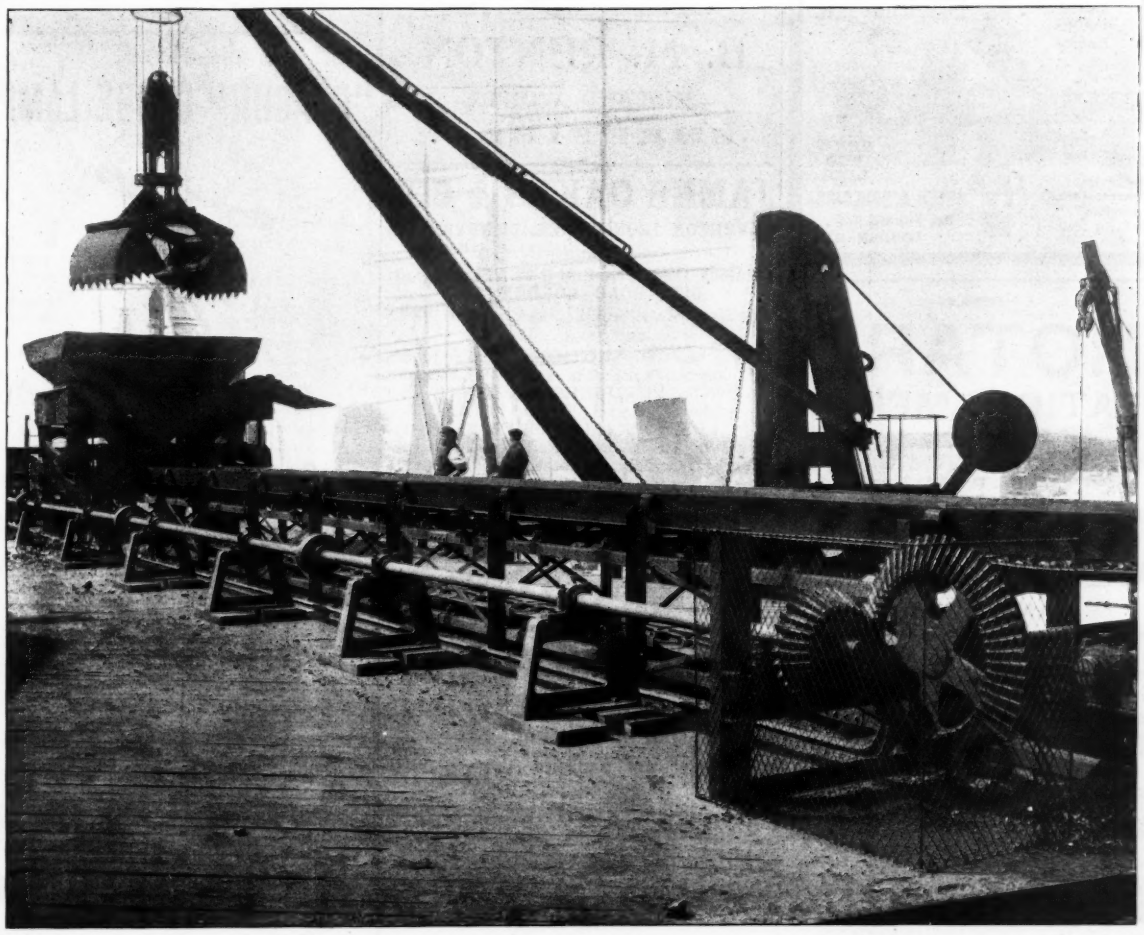

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No. 38.] [*Tuesday, April 26, 1904.*

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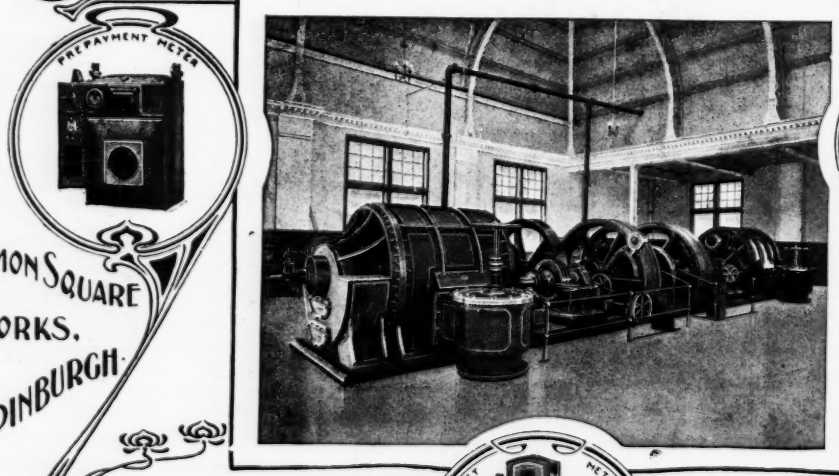

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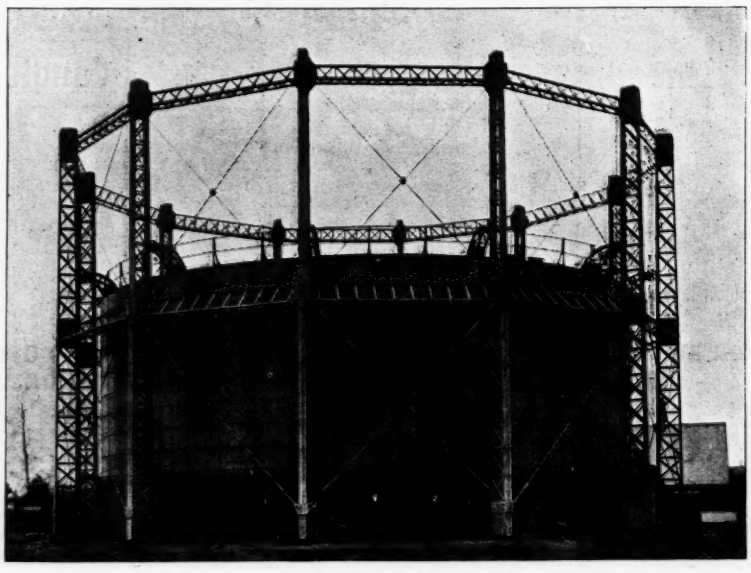

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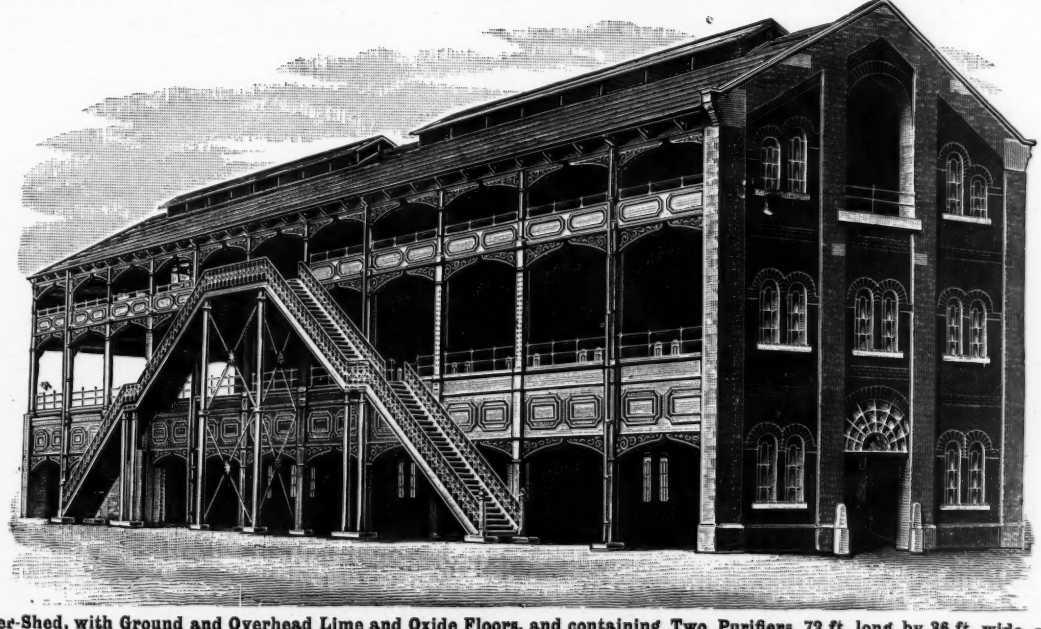

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